F02B

INTERNAL-COMBUSTION PISTON ENGINES; COMBUSTION ENGINES IN GENERAL (cyclically operating valves therefor F01L; lubricating internal-combustion engines F01M; gas-flow silencers or exhaust apparatus therefor F01N; cooling of internal-combustion engines F01P; internal-combustion turbines F02C; plants in which engines use combustion products F02C, F02G)

Definition statement

This place covers:

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

Engines characterised by the method of introducing liquid fuel into cylinders

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

Engines characterised by provision for charging or scavenging

Engines characterised by provision of driven charging or scavenging pumps

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

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

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

Internal combustion aspects of reciprocating-piston engines with movable cylinders

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

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Apparatus for generating fuel, e.g. gas, see the relevant classes, e.g.</th>
<th>C10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary-piston or oscillating-piston</td>
<td>F01C</td>
</tr>
<tr>
<td>Non-positive-displacement type</td>
<td>F01D</td>
</tr>
<tr>
<td>Steam engines plants</td>
<td>F01K</td>
</tr>
<tr>
<td>Cyclically operating valves for machines or engines</td>
<td>F01L</td>
</tr>
<tr>
<td>Lubrication of machines or engines in general</td>
<td>F01M</td>
</tr>
<tr>
<td>Exhaust Apparatus</td>
<td>F01N</td>
</tr>
<tr>
<td>Cooling of Engines</td>
<td>F01P</td>
</tr>
<tr>
<td>Gas-turbine plants</td>
<td>F02C</td>
</tr>
<tr>
<td>Use of waste-heat of combustion engines</td>
<td>F02G</td>
</tr>
<tr>
<td>Carburattors, fuel-injection apparatus</td>
<td>F02M</td>
</tr>
<tr>
<td>Apparatus for performing such pretreatments or additions</td>
<td>F02M</td>
</tr>
<tr>
<td>Crankshafts, crossheads, connecting-rods</td>
<td>F16C</td>
</tr>
</tbody>
</table>
Flywheels

Gearings for interconverting rotary motion and reciprocating motion in general

Pistons, piston rods, cylinders for engines in general

<table>
<thead>
<tr>
<th>Glossary of terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>engine</strong></td>
</tr>
<tr>
<td><strong>pump</strong></td>
</tr>
<tr>
<td><strong>machine</strong></td>
</tr>
<tr>
<td><strong>positive displacement</strong></td>
</tr>
<tr>
<td><strong>non-positive displacement</strong></td>
</tr>
<tr>
<td><strong>oscillating-piston machine</strong></td>
</tr>
<tr>
<td><strong>rotary-piston machine</strong></td>
</tr>
<tr>
<td><strong>rotary piston</strong></td>
</tr>
<tr>
<td><strong>cooperating members</strong></td>
</tr>
<tr>
<td><strong>movement of the co-operating members</strong></td>
</tr>
<tr>
<td><strong>teeth or tooth equivalents</strong></td>
</tr>
<tr>
<td><strong>internal-axis type</strong></td>
</tr>
</tbody>
</table>
free piston
a piston of which the length of stroke is not defined by any member driven thereby;

cylinders
positive-displacement working chambers in general. Thus, this term is not restricted to cylinders of circular cross-section;

main shaft
the shaft which converts reciprocating piston motion into rotary motion or vice versa;

plant
an engine together with such additional apparatus as is necessary to run the engine. For example, a steam engine plant includes a steam engine and means for generating the steam;

working fluid
the driven fluid in a pump or the driving fluid in an engine. The working fluid can be in a compressible, gaseous state, called elastic fluid, e.g. steam; in a liquid state; or in a state where there is coexistence of an elastic fluid and liquid phase.

steam
includes condensable vapours in general, and "special vapour" is used when steam is excluded;

reaction type
as applied to non-positive-displacement machines or engines means machines or engines in which pressure/velocity transformation takes place wholly or partly in the rotor. Machines or engines with no, or only slight, pressure/velocity transformation in the rotor are called "impulse type".

**F02B 1/00**

Engines characterised by fuel-air mixture compression (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition **F02B 11/00**; characterised by precombustion chambers **F02B 19/00**; characterised by air-storage chambers **F02B 21/00**; characterised by special shape or construction of combustion chambers **F02B 23/00**)

**Definition statement**

*This place covers:

Engine working on the compression of a homogeneous mixture of air and fuel.

The scope of this group is very wide so that it only makes sense to classify specific documents in the subgroups for which there is no other relevant classification.

**References**

*Limiting references*

*This place does not cover:*

<table>
<thead>
<tr>
<th>Characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition</th>
<th>F02B 11/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characterised by precombustion chambers</td>
<td>F02B 19/00</td>
</tr>
<tr>
<td>Characterised by air-storage chambers</td>
<td>F02B 21/00</td>
</tr>
<tr>
<td>Characterised by special shape or construction of combustion chambers</td>
<td>F02B 23/00</td>
</tr>
</tbody>
</table>
Synonyms and Keywords

In patent documents, the following abbreviations are often used:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCCI</td>
<td>Homogeneous Charge Compression Ignition</td>
</tr>
<tr>
<td>PCCI</td>
<td>Premixed Charge Compression Ignition</td>
</tr>
</tbody>
</table>

F02B 1/02

with positive ignition (with non-timed positive ignition F02B 9/06)

Definition statement

This place covers:

This group covers engines with positive ignition.

Just like F02B 1/00 the scope is too wide to classify all spark ignition (SI) engines.

Because of lack of discrimination of this class, it is in use primarily to classify engines running on alcohol (ethanol).

F02B 1/04

with fuel-air mixture admission into cylinder

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Term</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct injection petrol engines</td>
<td>F02B 2075/125</td>
</tr>
</tbody>
</table>

F02B 1/06

Methods of operating

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling engines</td>
<td>F02D</td>
</tr>
</tbody>
</table>

F02B 1/08

with separate admission of air and fuel into cylinder

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>With compression ignition</td>
<td>F02B 1/12</td>
</tr>
</tbody>
</table>
F02B 1/10
Methods of operating

References

Informative references
Attention is drawn to the following places, which may be of interest for search:

| Controlling combustion engines | F02D |

F02B 1/12
with compression ignition (with fuel-air charge ignited by compression ignition of an additional fuel F02B 7/00)

Definition statement
This place covers:
Engines operating on "homogeneous" mixed air-fuel.

Synonyms and Keywords
In patent documents, the following abbreviations are often used:

<table>
<thead>
<tr>
<th>HCCI</th>
<th>Homogeneous Charge Compression Ignition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCCI</td>
<td>Premixed Charge Compression Ignition</td>
</tr>
</tbody>
</table>

F02B 3/00
Engines characterised by air compression and subsequent fuel addition (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

Definition statement
This place covers:
Engines characterised by air compression and subsequent fuel addition. E.g. diesel engines, but this group also covers engines with air compression and subsequent gasoline fuel addition as in gasoline direct injection.

References

Limiting references
This place does not cover:

| Characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition | F02B 11/00 |
| Characterised by precombustion chambers | F02B 19/00 |
| Characterised by air-storage chambers | F02B 21/00 |
Characterised by special shape or construction of combustion chambers

F02B 3/02

with positive ignition (with non-timed positive ignition F02B 9/06)

Definition statement

This place covers:
Air compressing engines with spark ignition.

References

Limiting references

This place does not cover:

With non-timed positive ignition F02B 9/06

F02B 3/04

Methods of operating

References

Limiting references

This place does not cover:

Controlling combustion engines F02D
Electrical control of combustion engines F02D 41/00
**F02B 3/06**

with compression ignition (F02B 13/02 takes precedence; with fuel-air charge ignited by compression ignition of an additional fuel F02B 7/00)

**Definition statement**

*This place covers:*

In short: The Diesel engine. Preferably only deviations of the Diesel engine should be classified here.
F02B 3/08
Methods of operating (F02B 3/12 takes precedence)

Definition statement
This place covers:
The method of operating should be a deviation of the “normal Diesel”. Normally the method of operating is already embodied in the engine itself.

References
Limiting references
This place does not cover:
Control of combustion engine F02D

F02B 3/10
with intermittent fuel introduction

Definition statement
This place covers:
More than one injection per cycle or very closely spaced multiple injections

References
Limiting references
This place does not cover:
Controlling fuel injection of the high pressure type with multiple injections F02D 41/402
Fuel injection apparatus with each cyclic delivery being separated into two or more parts

F02M 45/02

F02B 5/00

Engines characterised by positive ignition (F02B 1/02, F02B 3/02 take precedence; with non-timed positive ignition F02B 9/06; characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

Definition statement

This place covers:
Engines characterised by positive ignition.

References

Limiting references

This place does not cover:

| Engines characterised by fuel-air mixture compression with positive ignition | F02B 1/02 |
| Engines characterised by air compression and subsequent fuel addition with positive ignition | F02B 3/02 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Engines with non-timed positive ignition, e.g. with hot-spots | F02B 9/06 |
| Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition | F02B 11/00 |
| Engines characterised by special shape or construction of combustion chambers | F02B 23/00 |

F02B 5/02

Methods of operating

References

Limiting references

This place does not cover:

| Control of combustion engines | F02D |
F02B 7/00

Engines characterised by the fuel-air charge being ignited by compression ignition of an additional fuel (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

Definition statement

This place covers:

Engines characterised by the fuel-air charge being ignited by compression ignition of an additional fuel. E.g. a compressed fuel-air mixture being ignited by directly injecting a diesel fuel.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition</td>
<td>F02B 11/00</td>
</tr>
<tr>
<td>Engines characterised by precombustion chambers</td>
<td>F02B 19/00</td>
</tr>
<tr>
<td>Engines characterised by air-storage chambers</td>
<td>F02B 21/00</td>
</tr>
<tr>
<td>Engines characterised by special shape or construction of combustion chambers</td>
<td>F02B 23/00</td>
</tr>
</tbody>
</table>

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot injection</td>
<td>The injection of an additional fuel for ignition of a compressed fuel-air mixture</td>
</tr>
</tbody>
</table>
F02B 9/00

Engines characterised by other types of ignition (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

Definition statement

This place covers:
Engines characterised by other types of ignition.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition | F02B 11/00 |
| Engines characterised by precombustion chambers | F02B 19/00 |
| Engines characterised by air-storage chambers | F02B 21/00 |
| Engines characterised by special shape or construction of combustion chambers | F02B 23/00 |

F02B 9/08

with incandescent chambers

Special rules of classification

Illustrative example of subject matter classified in F02B 9/08
E.g. "Hot bulb" engines

F02B 11/00

Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition, e.g. in different cylinders (characterised by recombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

Definition statement

*This place covers:*

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. E.g.: engines switching between positive ignition and compression ignition, or performing homogeneous charge
compression ignition combustion during a first operating condition, and performing spark ignition or "diesel" combustion during a second operating condition.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Engines characterised by precombustion chambers | F02B 19/00 |
| Engines characterised by air-storage chambers | F02B 21/00 |
| Engines characterised by special shape or construction of combustion chambers | F02B 23/00 |

F02B 13/00

Engines characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid

Definition statement

This place covers:

Engines characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid.

E.g. using compressed air or gas for blowing fuel into combustion chamber.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Fuel injection apparatuses where fuel-injection is effected by means of high-pressure gas | F02M 67/00 |
F02B 15/00

Engines characterised by the method of introducing liquid fuel into cylinders and not otherwise provided for

Definition statement

This place covers:

This group is only used for exceptional cases of engines with fuel introduction into cylinder that cannot be classified elsewhere.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Direct injection</th>
<th>F02B 2075/125</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect injection</td>
<td>F02M</td>
</tr>
</tbody>
</table>

F02B 17/00

Engines characterised by means for effecting stratification of charge in cylinders

Definition statement

This place covers:

Engines characterized by means for effecting stratification of charge in cylinders.

In a stratified charge engine, the fuel is injected into the cylinder just before ignition. This allows for higher compression ratios without "knock," and leaner air/fuel mixtures than in conventional internal combustion engines.

Relationships with other classification places

The stratification of the charge of air and fuel in the cylinder is determined by:

the shape of the air intake, the position of the fuel injector, the shape of the cylinder head, the shape of the piston head or combustion space.

References

Limiting references

This place does not cover:

| Engines with air compression and subsequent fuel addition | F02B 3/00 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Combustion chambers (shape)</th>
<th>F02B 23/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifying induction systems for imparting a rotation to the charge in the cylinder</td>
<td>F02B 31/00</td>
</tr>
<tr>
<td>Electrical control of supply of combustible mixture or its constituents</td>
<td>F02D 41/00</td>
</tr>
</tbody>
</table>
Special rules of classification

Classification should be limited to the constructional features of the combustion chamber for making stratification of charge possible.

Control features are classified in F02D

F02B 17/005: having direct injection in the combustion chamber

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratification</td>
<td>Layers of air and fuel</td>
</tr>
<tr>
<td>Charge</td>
<td>Air and/or fuel contents in cylinder</td>
</tr>
</tbody>
</table>

F02B 19/00

Engines characterised by precombustion chambers (engines with incandescent chambers F02B 9/08)

Definition statement

This place covers:

Engines characterized by pre-combustion chambers.

Chambers are located at the cylinder head and connected to the engine cylinder by small holes. Generally the following steps in the combustion take place. During the compression stroke, air from the main cylinder enters the pre-combustion chamber. At this moment, fuel is injected into the pre-combustion chamber and is ignited by a spark plug or a glow plug. Pressure increases and the ignited charge is forced through the small holes into the main cylinder, resulting in an ignition of the main charge in the combustion chamber.

Relationships with other classification places


References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Engine Type</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines with incandescent chambers</td>
<td>F02B 9/08</td>
</tr>
<tr>
<td>Engines with air storage chambers</td>
<td>F02B 21/00</td>
</tr>
</tbody>
</table>

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Engine Type</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines with fuel air mixture compression</td>
<td>F02B 1/00</td>
</tr>
<tr>
<td>Engines with special shape of combustion chamber</td>
<td>F02B 23/00</td>
</tr>
<tr>
<td>Cylinders; Cylinder heads</td>
<td>F02F 1/00</td>
</tr>
</tbody>
</table>
Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incandescent chamber</td>
<td>Chamber with hot spot</td>
</tr>
<tr>
<td>Torch passage</td>
<td>Passage between pre- and main combustion chamber</td>
</tr>
<tr>
<td>Squish area</td>
<td>Compressed area between piston top and cylinder head</td>
</tr>
<tr>
<td>Air swirl</td>
<td>Rotational movement of air</td>
</tr>
</tbody>
</table>

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "pre-combustion chamber", "pre-chamber" and "ignition chamber"

F02B 21/00

Engines characterised by air-storage chambers

Definition statement

This place covers:

Engines with an auxiliary chamber which is connected and disconnected with the engine intake or cylinder during the compression or expansion period of the engine cycle in order to influence the compression or expansion process.

Relationships with other classification places

Provision for charging and scavenging, F02B 29/00. Pumps for air charging and scavenging, F02B 33/00. Using engine as a brake, F02D 13/00.

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Term</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air hybrid prime movers</td>
<td>B60K 6/08</td>
</tr>
<tr>
<td>Compressed air driven engines</td>
<td>F01B 29/08</td>
</tr>
</tbody>
</table>

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders; cylinder heads</td>
<td>F02F 1/00</td>
</tr>
</tbody>
</table>

Special rules of classification

F02B 21/02: Chamber shapes or constructions

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary chamber</td>
<td>Chamber not being a combustion chamber</td>
</tr>
</tbody>
</table>
Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "air storage chamber" and "air accumulator"
- "auxiliary chamber" and "air tank"

F02B 23/00

Other engines characterised by special shape or construction of combustion chambers to improve operation (engines with incandescent chambers F02B 9/08)

Definition statement

This place covers:

Engines characterised by a special shape of the combustion chamber to improve operation. The shape of the combustion space between the cylinder head and the working piston determines how the combustible mixture of air and fuel is combusted. The group mainly deals with the configuration of the combustion space in the piston for compression but also for spark ignited engines.

Relationships with other classification places

Configuration of cylinder heads and pistons, F02F 1/00. Position of fuel injectors, F02B 23/10 and air intake systems, F02B 31/00.

References

Limiting references

This place does not cover:

| Engines with incandescent chambers | F02B 9/08 |
| Cylinders                         | F02F 1/00 |
| Pistons                           | F02F 3/00 |
| Fuel injectors                    | F02M 39/00 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Air Induction systems             | F02B 31/00 |
| Cylinders                         | F02F 1/00  |
| Pistons                           | F02F 3/00  |

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

| Squish flow | Flow through a narrowing area |
| Swirl flow  | Flow in a circular current   |
F02B 25/00

Engines characterised by using fresh charge for scavenging cylinders
(aspects characterised by provision of driven charging or scavenging pumps
F02B 33/00 - F02B 39/00)

Definition statement

This place covers:

Engines characterized by using fresh charge for scavenging cylinders.

Mostly two-stroke engines i.e. internal combustion engines that complete the process cycle in one revolution of the crankshaft, i.e. an up stroke and a down stroke of the piston. This is accomplished by using the beginning of the compression stroke and the end of the combustion stroke to perform simultaneously the intake and exhaust or scavenging functions. In this way, two-stroke engines often provide high specific power, at least in a narrow range of rotational speeds. The functions of some or all of the valves required by a four-stroke engine are usually served in a two-stroke engine by ports that are opened and closed by the motion of the piston.

Relationships with other classification places

Gasoline, spark ignition versions are particularly useful in lightweight portable applications, such as lawn mowers. The concept is also used in diesel compression ignition engines in large applications, such as ships and locomotives.

References

Limiting references

This place does not cover:

| Aspects characterized by provision of driven charging or scavenging pumps. | F02B 33/00 - F02B 39/00 |
| Rotary engines | F02B 57/00 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Pumps for charging or scavenging | F02B 33/00 |
| Engines for driving hand-held tools | F02B 63/00 |
| Other types of engines | F02B 75/00 |
| Rotary valve arrangements | F01L 7/00 |
| Cylinders; cylinder heads | F02F 1/00 |

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

| Unidirectional scavenging | Scavenging gas flows in one direction in the cylinder |
| Reverse-flow scavenging | Scavenging gas flows up and down again |
| Reed valve | Type of unidirectional valve |
**F02B 27/00**

Use of kinetic or wave energy of charge in induction systems, or of combustion residues in exhaust systems, for improving quantity of charge or for increasing removal of combustion residues (aspects characterised by provision of driven charging or scavenging pumps F02B 33/00 - F02B 39/00, e.g. use of driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge F02B 33/42)

**Definition statement**

*This place covers:*

Internal combustion engines with a variable configuration intake manifold or exhaust manifold technology. Variable configuration intake or exhaust manifold technology can vary the configuration of the intake or exhaust tract in order to optimise power and torque across the range of engine speed operation, as well as help provide better fuel efficiency. The effect is often achieved by having two separate intake ports, each controlled by a valve, that open two different manifolds - one with a short path that operates at full engine load, and another with a significantly longer path that operates at lower load.

**Relationships with other classification places**

Engines characterized by provisions for charging or scavenging not provided for in groups F02B 25/00, F02B 27/00, F02B 33/00 - F02B 39/00

**References**

**Limiting references**

*This place does not cover:*

<table>
<thead>
<tr>
<th>Aspects characterized by provision of driven charging or scavenging pumps</th>
<th>F02B 33/00 - F02B 39/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge</td>
<td>F02B 33/42</td>
</tr>
</tbody>
</table>

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

<table>
<thead>
<tr>
<th>Modifying induction systems</th>
<th>F02B 31/00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust silencing apparatus</td>
<td>F01N 1/00</td>
</tr>
</tbody>
</table>

**Glossary of terms**

*In this place, the following terms or expressions are used with the meaning indicated:*

| Resonance charging | Oscillating air column charging |
F02B 29/00

Engines characterised by provision for charging or scavenging not provided for in groups F02B 25/00, F02B 27/00 or F02B 33/00 - F02B 39/00; Details thereof

Definition statement

This place covers:

Means to improve the engine's volumetric efficiency by increasing the air intake density. The pressure of ambient air drawn in is increased and the temperature is decreased before it enters into the engine cylinder. This results in a greater mass of air entering the cylinder on each intake stroke.

Relationships with other classification places

Usually pumps, F02B 33/00 or turbochargers, F02B 37/00 are used to improve the engine's volumetric efficiency by increasing the air intake density. The compressor draws in ambient air and compresses it before it enters into the intake manifold at increased pressure. This results in a greater mass of air entering the cylinders on each intake stroke. In combination with these chargers provision, like cooling, F02B 29/00 or resonance charging, F02B 27/00 can be foreseen to improve the efficiency of these machines.

References

Limiting references

This place does not cover:

| Resonance charging                 | F02B 27/00 |
| Pumps for charging or scavenging   | F02B 33/00 |
| Turbo charging                     | F02B 37/00 |

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

| Fluid dynamic features | For example: air storage tanks |
| After charging         | Charging after turbo or super charging |

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "heat exchanger" and "cooler"

F02B 31/00

Modifying induction systems for imparting a rotation to the charge in the cylinder (structural features of induction systems F02M)

Definition statement

This place covers:

Modifications of the induction system of internal combustion engines to improve the mixing and distribution of air and fuel in the cylinder. The group covers modifications to the intake passages up until the intake port of the cylinder of the engine.
Relationships with other classification places

A specific geometry of the induction system can create a beneficial air swirl or tumble pattern in the combustion chamber. The swirl or tumble helps to distribute the fuel and form a homogeneous air-fuel mixture. This aids the initiation of the combustion process.

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Term</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of combustion chamber</td>
<td>F02B 23/00</td>
</tr>
<tr>
<td>Lift valves</td>
<td>F01L 3/00</td>
</tr>
<tr>
<td>Cylinders, cylinder heads</td>
<td>F02F 1/00</td>
</tr>
<tr>
<td>Air induction systems</td>
<td>F02M 35/00</td>
</tr>
</tbody>
</table>

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air induction systems</td>
<td>F02M 35/00</td>
</tr>
</tbody>
</table>

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swirl</td>
<td>Rotation around cylinder axis</td>
</tr>
<tr>
<td>Tumble</td>
<td>Rotation around transverse cylinder axis</td>
</tr>
</tbody>
</table>

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "swirl" and "turbulence"

F02B 33/00

Engines characterised by provision of pumps for charging or scavenging (characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid F02B 13/00; characterised by after-charging F02B 29/06; characterised by provision of pumps for sucking combustion residues from cylinders F02B 35/00; characterised by provision of exhaust-driven pumps F02B 37/00)

Definition statement

This place covers:

Engines characterised by provision of pumps for charging or scavenging.
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines characterised by introducing fuel into cylinders by auxiliary fluid, e.g. by air-pressure</td>
<td>F02B 13/00</td>
</tr>
<tr>
<td>After-charging</td>
<td>F02B 29/06</td>
</tr>
<tr>
<td>Engines with pumps for sucking combustion residues from cylinders</td>
<td>F02B 35/00</td>
</tr>
<tr>
<td>Exhaust-driven pumps</td>
<td>F02B 37/00</td>
</tr>
<tr>
<td>Arrangements of such pumps or other auxiliary apparatus on engines</td>
<td>F02B 67/00</td>
</tr>
<tr>
<td>Turbochargers per se</td>
<td>F02C</td>
</tr>
<tr>
<td>Combined engine and pump control, control dependent on variables other than those generic to pumps</td>
<td>F02D</td>
</tr>
<tr>
<td>Pumps per se</td>
<td>F04</td>
</tr>
</tbody>
</table>

F02B 33/04

with simple crankcase pumps, i.e. with the rear face of a non-stepped working piston acting as sole pumping member in co-operation with the crankcase

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders characterised by having ports in cylinder for scavenging or charging</td>
<td>F02F 1/22</td>
</tr>
</tbody>
</table>

Special rules of classification

Illustrative example of subject matter classified in F02B 33/04
E.g.:

**F02B 33/06**
with reciprocating-piston pumps other than simple crankcase pumps

**Definition statement**
This place covers:
With reciprocating-piston pumps other than simple crankcase pumps, e.g. engine-driven piston pumps.

**F02B 33/08**
with the working-cylinder head arranged between working and pumping cylinders

**Special rules of classification**
Illustrative example of subject matter classified in F02B 33/08
F02B 33/12

the rear face of working piston acting as pumping member and co-operating with a pumping chamber isolated from crankcase, the connecting-rod passing through the chamber and co-operating with movable isolating member

Special rules of classification

Illustrative example of subject matter classified in F02B 33/12

E.g.:
F02B 33/14
working and pumping pistons forming stepped piston

Special rules of classification
Illustrative example of subject matter classified in F02B 33/14

F02B 33/18
with crankshaft being arranged between working and pumping cylinders

Special rules of classification
Illustrative example of subject matter classified in F02B 33/18
**F02B 33/20**

with pumping-cylinder axis arranged at an angle to working-cylinder axis, e.g. at an angle of 90 degrees

**Special rules of classification**

Illustrative example of subject matter classified in **F02B 33/20**

E.g.:

![Diagram](image)

**F02B 33/22**

with pumping cylinder situated at side of working cylinder, e.g. the cylinders being parallel

**Special rules of classification**

Illustrative example of subject matter classified in **F02B 33/22**
E.g.:

**F02B 33/26**

Four-stroke engines characterised by having crankcase pumps

**Special rules of classification**

Illustrative example of subject matter classified in **F02B 33/26**

E.g.:
F02B 33/30
Control of inlet or outlet ports (controlling only working-cylinder inlets F01L)

Special rules of classification
Illustrative example of subject matter classified in F02B 33/30

E.g.:

---

F02B 33/32
Engines with pumps other than of reciprocating-piston type (with crankcase pumps F02B 33/02)

References
Limiting references
This place does not cover:

| Engines with crankcase pumps | F02B 33/02 |

F02B 33/34
with rotary pumps (with cell-type pressure exchangers or the like F02B 33/42)

References
Limiting references
This place does not cover:

| Cell-type pressure exchangers or the like | F02B 33/42 |
F02B 33/38
of Roots type

Special rules of classification
Illustrative example of subject matter classified in F02B 33/38
E.g.:

U.S. Patent Jun. 17, 1986 Sheet 1 of 2 4,594,6

F02B 33/40
of non-positive-displacement type

Special rules of classification
Illustrative example of subject matter classified in F02B 33/40
E.g.:

**F02B 33/42**

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](#))

**Definition statement**

*This place covers:*

Engine with driven or non-driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge, e.g. with cell-type pressure exchangers.
E.g.:

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Pressure exchangers per se | F04F 13/00 |

**F02B 33/44**

Passages conducting the charge from the pump to the engine inlet, e.g. reservoirs (cooling of charge after leaving pumps F02B 29/04)

**Definition statement**

This place covers:

Passages conducting the charge from the pump to the engine inlet, e.g. reservoirs. This group covers also air passages of turbocharged engines and scavenging channels with special features in two-stroke engines.

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Cooling of charge after leaving the pump | F02B 29/04 |
**F02B 35/00**

Engines characterised by provision of pumps for sucking combustion residues from cylinders

**Definition statement**

This place covers:

Engines characterised by provision of pumps for sucking combustion residues from cylinders.

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>After-charging</th>
<th>F02B 29/06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrangements of such pumps or other auxiliary apparatus on engines</td>
<td>F02B 67/00</td>
</tr>
</tbody>
</table>

**F02B 35/02**

using rotary pumps

**Special rules of classification**

Illustrative example of subject matter classified in F02B 35/02

e.g.:
F02B 37/00

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 F02B 13/00; characterised by after-charging F02B 29/06; characterised by passages conducting the charge from the pump to the engine inlet F02B 33/44)

Definition statement

This place covers:
Engines with turbocharging.

References

Limiting references

This place does not cover:

| Engines characterised by provision of driven charging or scavenging pumps. Introducing fuel into cylinders by air-pressure | F02B 13/00 |
| After-charging | F02B 29/06 |

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Passages conducting the charge from the pumps to the engine inlet | F02B 33/44 |
| Turbo-compound | F02B 41/10 |
| Arrangements of such pumps or other auxiliary apparatus on engines | F02B 67/00 |
| Details or constructional aspects of non-positive displacement machines or engines, e.g. turbines | F01D |
| Final actuators for bypassing part of the fluid in non-positive displacement machines or engines | F01D 17/105 |
| Turbocharger casings, arrangement of bearings in turbochargers, cooling or lubrication of turbochargers per se | F01D 25/00 |
| Turbochargers per se | F02C |
| Combined engine and pump control, control dependent on variables other than those generic to pump | F02D |
| Constructional aspects of pumps | F04C |
| Controls of pumps | F04D 15/00 |
| Valves in general | F16K |
F02B 37/007

with exhaust-driven pumps arranged in parallel {, e.g. at least one pump supplying alternatively}

Definition statement

This place covers:
with exhaust-driven pumps arranged in parallel. E.g. at least one parallel pump being driven alternatively.

F02B 37/013

with exhaust-driven pumps arranged in series

Special rules of classification

Illustrative example of subject matter classified in F02B 37/013
E.g.:

![Diagram](image)

**FIG. 1**

F02B 37/04

Engines with exhaust drive and other drive of pumps, e.g. with exhaust-driven pump and mechanically-driven second pump

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| The specific drive of the other drive | F02B 39/02 |

F02B 37/12

Control of the pumps

**Definition statement**

This place covers:

Control of turbocharging of engines. These groups cover also electronic control of turbochargers.

**References**

*Limiting references*

This place does not cover:

| Details or constructional aspects of turbines | F01D |
| Constructional details of devices for control of turbochargers | F01D, F02C |
| Turbochargers | F02C |
Combined engine and pump control, control dependent on variables other than those generic to pump | F02D
---|---
Controlling supercharged engines | F02D 23/00
Pumps | F04

**F02B 37/14**

{Control} of the alternation between {or the operation of} exhaust drive and other drive of a pump, e.g. dependent on speed

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Drives of a pump | F02B 39/02 |
---|---|

**F02B 37/16**

by bypassing charging air

**Definition statement**

This place covers:

Illustrative example of subject matter classified in F02B 37/16

![Diagram](image)

**F02B 37/162**

{by bypassing, e.g. partially, intake air from pump inlet to pump outlet}

**Definition statement**

This place covers:

Control of pumps by bypassing air from the pump inlet to the pump outlet.
References

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

| Valves for admission of atmospheric air to engine | F02B 33/446 |

**F02B 37/168**

{into the exhaust conduit (F02B 37/166 takes precedence)}

**Definition statement**

*This place covers:*

Control of pumps by bypassing charging air into the exhaust conduit.

**References**

**Limiting references**

*This place does not cover:*

| The bypassed air being used in a combustion chamber | F02B 37/166 |

**F02B 37/18**

by bypassing exhaust {from the inlet to the outlet of turbine or to the atmosphere}

**Definition statement**

*This place covers:*

Controlling the pump by bypassing exhaust.

**References**

**Limiting references**

*This place does not cover:*

| Constructional aspects of bypass valves | F01D 17/105 |

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

| Valves in general | F16K |
F02B 37/183
{Arrangements of bypass valves or actuators therefor}

References
Limiting references
This place does not cover:

| Constructional aspects of bypass valves | F01D 17/105 |

Informative references
Attention is drawn to the following places, which may be of interest for search:

| Valves in general | F16K |
| Actuating devices in general | F16K 31/00 |

F02B 37/186
{Arrangements of actuators or linkage for bypass valves}

Definition statement
This place covers:
arrangement of actuators and linkage for bypass valves.

References
Limiting references
This place does not cover:

| Actuating devices per se | F16K 31/00 |

F02B 37/20
by increasing exhaust energy, e.g. using combustion chamber {by after-burning (using an auxiliary combustion chamber supplied by charging air F02B 37/166)}

Definition statement
This place covers:
by increasing exhaust energy, e.g. using combustion chamber upstream of turbine or injecting water.

References
Limiting references
This place does not cover:

| Using an auxiliary combustion chamber supplied by charging air | F02B 37/166 |
**F02B 37/22**

by varying cross-section of exhaust passages or air passages, {e.g. by throttling turbine inlets or outlets or by varying effective number of guide conduits *(F02B 37/24 takes precedence)*}

**Definition statement**

*This place covers:*

by varying cross-section of exhaust passages or air passages, e.g. by throttling turbine inlets or outlets or by varying effective number of guide conduits.

**References**

**Limiting references**

*This place does not cover:*

<table>
<thead>
<tr>
<th>By using pumps or turbines with adjustable guide vanes</th>
<th>F02B 37/24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructional aspects per se of such devices</td>
<td>F02C, F01D 17/14</td>
</tr>
</tbody>
</table>

**F02B 37/225**

{air passages}

**References**

**Limiting references**

*This place does not cover:*

| Constructional aspects per se of such devices | F02C, F01D |

**F02B 37/24**

by using pumps or turbines with adjustable guide vanes

**References**

**Limiting references**

*This place does not cover:*

| Constructional aspects per se of such devices | F01D 17/16, F02C |

**F02B 39/00**

Component parts, details, or accessories relating to, driven charging or scavenging pumps, not provided for in groups *(F02B 33/00 - F02B 37/00)*

**Definition statement**

*This place covers:*

Component parts, details, or accessories relating to, driven charging or scavenging pumps, not provided for in groups *(F02B 33/00 - F02B 37/00).*
References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Topic</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines characterised by provision of driven charging or scavenging</td>
<td>F02B 13/00</td>
</tr>
<tr>
<td>pumps. Introducing fuel into cylinders by air-pressure</td>
<td>F02B 29/06</td>
</tr>
<tr>
<td>After-charging</td>
<td>F02B 67/00</td>
</tr>
<tr>
<td>Arrangements of such pumps or other auxiliary apparatus on engines</td>
<td>F01D</td>
</tr>
<tr>
<td>Details or constructional aspects of turbines</td>
<td>F02C</td>
</tr>
<tr>
<td>Turbochargers</td>
<td>F02C</td>
</tr>
<tr>
<td>Plants in which engines use combustion products</td>
<td>F02C, F02G</td>
</tr>
<tr>
<td>Internal-combustion turbines</td>
<td>F02C</td>
</tr>
<tr>
<td>Combined engine and pump control, control dependent on variables</td>
<td>F02D</td>
</tr>
<tr>
<td>other than those generic to pump</td>
<td>F04</td>
</tr>
<tr>
<td>Pumps</td>
<td>F16</td>
</tr>
<tr>
<td>Pumps in general</td>
<td>F04</td>
</tr>
<tr>
<td>Machine element per se</td>
<td>F04</td>
</tr>
</tbody>
</table>

F02B 39/005

{Cooling of pump drives}

Definition statement

This place covers:

Arrangement of cooling system of super/turbocharger, layout (or partial layout) of cooling fluid circuits.

See e.g.:
References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbocharger cooling per se, e.g. cooling a turbocharger bearing per se</td>
<td>F01D, F01D 25/125,</td>
</tr>
<tr>
<td></td>
<td>F02C 6/12</td>
</tr>
<tr>
<td>Cooling of turbochargers</td>
<td>F01D 25/12</td>
</tr>
<tr>
<td>Cooling of turbocharger bearings</td>
<td>F01D 25/125</td>
</tr>
<tr>
<td>Cooling of turbocharger casing</td>
<td>F01D 25/14</td>
</tr>
<tr>
<td>Cooling of machines or engines in general; cooling of internal-combustion</td>
<td>F01P</td>
</tr>
<tr>
<td>engines</td>
<td></td>
</tr>
</tbody>
</table>

F02B 39/02

Drives of pumps (exhaust drives or combined exhaust and other drives F02B 37/00); Varying pump drive gear ratio (control acting both on engine and on pump drive gear ratio F02D)

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control acting both on engine and on pump drive gear ratio</td>
<td>F02D</td>
</tr>
</tbody>
</table>

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust drives or combined exhaust and other drives</td>
<td>F02B 37/00</td>
</tr>
</tbody>
</table>

F02B 39/04

Mechanical drives; Variable-gear-ratio drives (non-mechanical pump drives having variable gear ratio F02B 39/08)

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-mechanical pump drives having variable gear ratio</td>
<td>F02B 39/08</td>
</tr>
</tbody>
</table>
**F02B 39/12**

Drives characterised by use of couplings or clutches therein (using fluid slip couplings for varying gear ratio **F02B 39/08**)

**References**

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

| Using fluid slip couplings for varying gear ratio | **F02B 39/08** |

---

**F02B 39/14**

**Lubrication of pumps; Safety measures therefor**

**Definition statement**

*This place covers:*

Lubrication of pumps; Safety measures therefore, e.g. arrangement of lubrication system of super/turbocharger, layout (or partial layout) of lubrication fluid circuits.

**References**

**Limiting references**

*This place does not cover:*

<table>
<thead>
<tr>
<th>Lubricating of machines or engines in general; lubricating internal-combustion engines</th>
<th><strong>F01M</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbocharger lubrication per se, e.g. lubricating a turbocharger bearing per se</td>
<td><strong>F02C 6/12; F01D 25/18</strong></td>
</tr>
<tr>
<td>Lubrication of bearings in general</td>
<td><strong>F16C</strong></td>
</tr>
<tr>
<td>Lubricating in general</td>
<td><strong>F16N</strong></td>
</tr>
</tbody>
</table>

---

**F02B 39/16**

**Other safety measures for, or other control of, pumps**

**References**

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

<table>
<thead>
<tr>
<th>Cleaning of turbomachines</th>
<th><strong>F01D 25/002</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning of pumps using liquids</td>
<td><strong>F04D 29/705</strong></td>
</tr>
<tr>
<td>Measuring vibration of turbo machines</td>
<td><strong>G01H 1/006</strong></td>
</tr>
</tbody>
</table>
**F02B 41/00**

Engines characterised by special means for improving conversion of heat or pressure energy into mechanical power

**Definition statement**

*This place covers:*

Engines characterised by special means for improving conversion of heat or pressure energy into mechanical power, e.g. modification of compression ratio to enhance thermal efficiency or by using "turbocompound" i.e. using the exhaust to drive a turbine connected to the crankshaft.

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Term</th>
<th>CPC Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable compression ratio</td>
<td>F02B 75/04</td>
</tr>
<tr>
<td>Thermal insulation</td>
<td>F02B 77/11, F02B 77/02</td>
</tr>
<tr>
<td>Modified dwell of piston in TDC</td>
<td>F02B 2275/36</td>
</tr>
</tbody>
</table>

**F02B 41/02**

Engines with prolonged expansion

**Glossary of terms**

*In this place, the following terms or expressions are used with the meaning indicated:*

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged expansion</td>
<td>relative to the compression</td>
</tr>
<tr>
<td>Modified dwell</td>
<td>The piston remains longer than usual at TOP DEAD CENTRE</td>
</tr>
<tr>
<td>Miller cycle</td>
<td>A modified four stroke cycle where the compression stroke is made shorter by blow back through late inlet valve closing, for turbo charged engines</td>
</tr>
<tr>
<td>Atkinson cycle</td>
<td>the same as Miller cycle, but for normally aspirated engines</td>
</tr>
</tbody>
</table>

**F02B 41/04**

in main cylinders

**Definition statement**

*This place covers:*

Engines with means and ways to make the compression stroke and the expansion stroke different.
E.g. engines using the Miller or Atkins cycles or using mechanical means in order to have special stroke of piston.
F02B 41/06

in compound cylinders

Definition statement

This place covers:

Engines with more than one expansion stroke. I.e. the exhaust is allowed to expand in an additional cylinder. The compounding is similar to the compounding in a steam engine.
**F02B 41/08**

Two-stroke compound engines

**Definition statement**

*This place covers:*

Two stroke engines with second expansion in an expansion cylinder

![Diagram](image1)

**F02B 41/10**

in exhaust turbines (use of exhaust turbines for charging F02B 37/00; turbines constructions F01D; gas turbine plant F02C)

**Definition statement**

*This place covers:*

Turbocompounding. The exhaust gas is expanded in a turbine which is directly or indirectly connected to the engine crankshaft.

![Diagram](image2)
E.g.:

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Topic</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine construction</td>
<td>F01D</td>
</tr>
<tr>
<td>Gas turbine plants</td>
<td>F02C</td>
</tr>
<tr>
<td>Use of exhaust turbines for charging</td>
<td>F02M 37/00</td>
</tr>
</tbody>
</table>
F02B 43/00
Engines characterised by operating on gaseous fuels; Plants including such engines (engines characterised by the gas-air charge being ignited by compression ignition of an additional fuel F02B 7/06; engines convertible from gas to other fuel consumption F02B 69/04)

Definition statement
This place covers:
Engines characterised by operating on gaseous fuels; Plants including such engines

References

Limiting references
This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines characterised by the gas-air charge being ignited by compression</td>
<td>F02B 7/06</td>
</tr>
<tr>
<td>ignition of an additional fuel</td>
<td></td>
</tr>
<tr>
<td>Engines convertible from gas to other fuel consumption</td>
<td>F02B 69/04</td>
</tr>
<tr>
<td>Control of gas supply per se</td>
<td>F02D 19/00</td>
</tr>
<tr>
<td>Installations for supply of gas per se</td>
<td>F02M 21/00</td>
</tr>
</tbody>
</table>

Informative references
Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>CPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of gas engines</td>
<td>F02D 19/00</td>
</tr>
<tr>
<td>Fuel supply apparatuses</td>
<td>F02M 21/00</td>
</tr>
</tbody>
</table>
Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td>Liquefied Natural Gas; behaves like an inert gas. It has a high critical compression ratio. Therefore, only used with spark ignition or pilot fuel ignition</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>CNG</td>
<td>Compressed Natural Gas</td>
</tr>
<tr>
<td>DME</td>
<td>Dimethyl ether</td>
</tr>
</tbody>
</table>

F02B 43/10

Engines or plants characterised by use of other specific gases, e.g. acetylene, oxyhydrogen

Definition statement

This place covers:

Engines of plants characterised by use of other specific gases, e.g. acetylene, oxyhydrogen, hydrogen, oxygen.

References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Topic</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of hydrogen</td>
<td>C01B 3/02</td>
</tr>
<tr>
<td>Fuel cell per se</td>
<td>H01M 8/00</td>
</tr>
</tbody>
</table>

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Topic</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplying engines with gaseous fuel</td>
<td>F02M 21/02</td>
</tr>
</tbody>
</table>

F02B 43/12

Methods of operating

Definition statement

This place covers:

methods of operating such engines.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Topic</th>
<th>CPC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling combustion engines</td>
<td>F02D</td>
</tr>
</tbody>
</table>
**F02B 45/00**

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

**Definition statement**

*This place covers:*

Engines operating on non-liquid fuels other than gas, such as solid or semi-solid fuels.

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Plants involving generation of gaseous fuels from solid fuel</th>
<th>F02B 43/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engines convertible from gas to other fuel consumption</td>
<td>F02B 69/04</td>
</tr>
</tbody>
</table>

**F02B 45/02**

operating on powdered fuel, e.g. powdered coal (operating on fuel containing oxidant F02B 45/06)

**Definition statement**

*This place covers:*

operating of powdered fuel e.g. powdered coal

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Operating on fuel containing oxidant                        | F02B 45/06  |
F02B 47/00

Methods of operating engines involving adding non-fuel substances or anti-knock agents to combustion air, fuel, or fuel-air mixtures of engines

Definition statement
This place covers:
Methods of operating engines involving adding non-fuel substances or anti-knock agents to combustion air, fuel, or fuel-air mixtures of engines:

F02B 47/02

the substances being water or steam

References
Limiting references
This place does not cover:

Apparatus for adding water or steam to engine

F02M 25/00
**F02B 47/06**

The substances including non-airborne oxygen (**F02B 47/10** takes precedence)

**Definition statement**

This place covers:

The added substance including non-airborne oxygen, e.g. N2O: Laughing gas

---

**References**

**Limiting references**

This place does not cover:

<table>
<thead>
<tr>
<th>Circulation of exhaust gas in closed or semi-closed circuits</th>
<th>F02B 47/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparatus for supplying non-airborne oxygen to engine</td>
<td>F02M 25/10</td>
</tr>
</tbody>
</table>

---

**F02B 47/08**

The substances including exhaust gas

**References**

**Limiting references**

This place does not cover:

<table>
<thead>
<tr>
<th>Apparatus for adding exhaust gas to engines</th>
<th>F02M 26/00</th>
</tr>
</thead>
</table>

---
F02B 47/10
Circulation of exhaust gas in closed or semi-closed circuits, e.g. with simultaneous addition of oxygen

References

Limiting references
This place does not cover:

| Apparatus for adding exhaust gas to engine       | F02M 26/00 |

F02B 49/00
Methods of operating air-compressing compression-ignition engines involving introduction of small quantities of fuel in the form of a fine mist into the air in the engine's intake

Definition statement
This place covers:
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. E.g. as starting aid
F02B 51/00
Other methods of operating engines involving pretreating of, or adding substances to, combustion air, fuel, or fuel-air mixture of the engines

Definition statement
This place covers:
Other methods of operating engines involving pretreating of, or adding substances to, combustion air, fuel, or fuel-air mixture of the engines.

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Apparatuses for treating combustion-air, fuel of fuel-air mixture, by catalyst, electric means, magnetism, rays, sound waves or the like | F02M 27/00 |

F02B 51/02
involving catalysts

References
Limiting references
This place does not cover:

| Apparatus for treating combustion-air, fuel, or fuel-air mixture by catalyst | F02M 27/02 |

F02B 51/04
involving electricity or magnetism

References
Limiting references
This place does not cover:

| Apparatus for treating combustion-air, fuel, or fuel-air mixture by electric means or magnetism | F02M 27/04 |

F02B 51/06
involving rays or sound waves

References
Limiting references
This place does not cover:

| Apparatus for treating combustion-air, fuel, or fuel-air mixture by sonic or ultrasonic waves | F02M 27/08 |
**F02B 53/00**  
Internal-combustion aspects of rotary-piston or oscillating-piston engines  
(internal-combustion aspects of rotary pistons or outer members for co-operation therewith F02B 55/00)

**Definition statement**

*This place covers:*

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

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal combustion aspects of rotary pistons or outer members of co-operating therewith</td>
<td>F02B 55/00</td>
</tr>
<tr>
<td>Rotary-piston machines or engines per se</td>
<td>F01C 1/00, F01C 3/00, F01C 5/00, F01C 7/00</td>
</tr>
<tr>
<td>Oscillating-piston machines or engines</td>
<td>F01C 9/00</td>
</tr>
</tbody>
</table>

**F02B 55/00**  
Internal-combustion aspects of rotary pistons; Outer members for co-operation with rotary pistons

**Definition statement**

*This place covers:*

Internal combustion aspects of rotary pistons or outer members for co-operation with rotary pistons.

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary-piston machines or engines per se</td>
<td>F01C 1/00, F01C 3/00, F01C 5/00, F01C 7/00</td>
</tr>
<tr>
<td>Oscillating-piston machines or engines</td>
<td>F01C 9/00</td>
</tr>
</tbody>
</table>

**F02B 55/10**  
Cooling thereof

**Special rules of classification**

Illustrative example of subject matter classified in F02B 55/10
E.g.
F02B 57/00
Internal-combustion aspects of rotary engines in which the combusted gases displace one or more reciprocating pistons

Definition statement
This place covers:
Internal-combustion aspects of rotary engines in which the combusted gases displace one or more reciprocating pistons. E.g.:

F02B 57/02
Fuel or combustion-air supply (cylinder-charge admission or exhaust control F02B 57/04)

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Cylinder-charge admission of exhaust control | F02B 57/04 |
F02B 57/04

Control of cylinder-charge admission or exhaust (peculiar to two-stroke engines or to other engines with working-piston-controlled charge admission or exhaust F02B 57/06)

References

Limiting references

This place does not cover:

| Two-stroke engines or other engines with working-piston-controlled charge admission or exhaust | F02B 57/06 |

F02B 57/06

Two-stroke engines or other engines with working-piston-controlled cylinder-charge admission or exhaust (with combustion space in centre of star F02B 57/10)

References

Limiting references

This place does not cover:

| With combustion space in centre of star | F02B 57/10 |
**F02B 57/08**

Engines with star-shaped cylinder arrangements

**Definition statement**

*This place covers:*

Engines with star-shaped cylinder arrangements, e.g.

---

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

| Reciprocating-piston machines or engines with the rotating cylinders arranged substantially tangentially to a circle centred on the main shaft axis | F01B 13/045 |
| Reciprocating-piston machines or engines with rotating cylinders in star arrangement | F01B 13/06 |
F02B 57/10
with combustion space in centre of star

Definition statement

This place covers:
Engines with combustion space in centre of star, e.g.:
F02B 59/00
Internal-combustion aspects of other reciprocating-piston engines with movable, e.g. oscillating, cylinders (with yieldable walls F02B 75/38)

Definition statement

This place covers:
Internal-combustion aspects of other reciprocating-piston engines with movable, e.g. oscillating, cylinders. E.g.:

References

Limiting references

This place does not cover:

| Reciprocating-piston engines with parts of combustion- or working-chamber walls resiliently yielding under pressure | F02B 75/38 |
F02B 61/00

Adaptations of engines for driving vehicles or for driving propellers; Combinations of engines with gearing (the engine torque being divided by a differential gear for driving a scavenging or charging pump and the engine output shaft F02B 39/06; adaptations or combinations of rotary-piston or oscillating-piston engines F02B 53/14; arrangements in vehicles, see the relevant classes for vehicles)

Definition statement

This place covers:

Adaptations of engines for driving vehicles or for driving propellers; Combinations of engines with gearing.

References

Limiting references

This place does not cover:

| Engine torque being divided by a differential gear for driving a scavenging or charging pump and the engine output shaft | F02B 39/06 |
| Adaptions of combinations of rotay-piston or oscillating-piston engines | F02B 53/14 |
| Arrangement in vehicles | see the relevant classes for the specific vehicles |
F02B 61/02
for driving cycles

Definition statement
This place covers:
Engines for driving cycles; E.g.:
**F02B 61/04**

for driving propellers

**Definition statement**

This place covers:

Engines for driving propellers; E.g.:

![FIG. 1](image1)

![FIG. 2](image2)

![FIG. 3](image3)
F02B 61/045
{for outboard marine engines}

Definition statement
This place covers:
Outboard marine and engines, Inboard marine engines, Jetski engines.
F02B 61/06
Combinations of engines with mechanical gearing (F02B 61/02, F02B 61/04 take precedence)

Definition statement
This place covers:
Combinations of engines with mechanical gearing

References
Limiting references
This place does not cover:

| Adaptations of engines for driving cycles                     | F02B 61/02 |
| Adaptations of engines for driving propellers               | F02B 61/04 |

F02B 63/00
Adaptations of engines for driving pumps, hand-held tools or electric generators; Portable combinations of engines with engine-driven devices (of rotary-piston or oscillating-piston engines F02B 53/14)

Definition statement
This place covers:
Adaptations of engines for driving pumps, hand-held tools or electric generators; Portable combinations of engines with engine-driven devices
References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Adaptations of rotary-piston or oscillating-piston engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>F02B 53/14</td>
</tr>
</tbody>
</table>

F02B 63/00

for electric generators

Definition statement

This place covers:

Adaptations of engines for electric generators; E.g.: [Diagram]

F02B 65/00

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

Definition statement

This place covers:

Adaptations of engines for special uses not provided for in groups F02B 61/00 or F02B 63/00; Combinations of engines with other devices, e.g. with non-driven apparatus. E.g. Internal combustion engine where an engine cylinder may act as an air compressor
References

Limiting references

This place does not cover:

<table>
<thead>
<tr>
<th>Description</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptations of rotary-piston or oscillating-piston engines</td>
<td>F02B 53/14</td>
</tr>
<tr>
<td>Combinations of prime-movers consisting of electric motors and internal</td>
<td>B60K 6/20</td>
</tr>
<tr>
<td>combustion engines for mutual or common propulsion</td>
<td></td>
</tr>
</tbody>
</table>

F02B 67/00

Engines characterised by the arrangement of auxiliary apparatus not being otherwise provided for, e.g. the apparatus having different functions; Driving auxiliary apparatus from engines, not otherwise provided for.

Definition statement

This place covers:

Engines characterised by the arrangement of auxiliary apparatuses not being otherwise provided for, e.g. the apparatus having different functions; Driving auxiliary apparatus from engines, not otherwise provided for.

F02B 67/06

Driven by means of chains, belts, or like endless members

Definition statement

This place covers:

Auxiliary devices driven by means of chains, belts, or like endless members.
**F02B 67/08**

of non-mechanically driven auxiliary apparatus

**Definition statement**

This place covers:

Non-mechanically driven auxiliary apparatus. E.g. electrically, hydraulically or pneumatically driven.

**F02B 67/10**

of charging or scavenging apparatus

**Definition statement**

This place covers:

Engines characterised by the arrangement charging or scavenging apparatus. E.g driving arrangement or mounting arrangement. Also for particular positioning with respect to engine.

**F02B 69/00**

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

**Definition statement**

This place covers:

Internal combustion engines convertible into other combustion-engine type not provided for in **F02B 11/00**; Internal-combustion engines of different types characterised by constructions facilitating use of same main engine-parts in different types.
E.g. engines convertible from two stroke to four stroke, or convertible for use with different fuels

**References**

**Limiting references**

This place does not cover:

| 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 | F02B 13/00 |

**F02B 71/00**

Free-piston engines; Engines without rotary main shaft

**Definition statement**

This place covers:

Free-piston engines; Engines without rotary main shaft. E.g.:
**F02B 73/00**

**Combinations of two or more engines, not otherwise provided for**

**Definition statement**

*This place covers:*

E.g. combining two or more engines, not otherwise provided for, e.g. of the same or different type, e.g. an internal combustion engine and a Stirling engine.

**F02B 75/00**

**Other engines**

**Definition statement**

*This place covers:*

Other engines
F02B 75/002

{Double acting engines}

Definition statement

This place covers:

Double acting engines

![Diagram of a double acting engine](image-url)
F02B 75/005
{having horizontal cylinders (F02B 75/007 takes precedence)}

Definition statement

This place covers:

Engines having horizontal cylinders. E.g.:

References

Limiting references

This place does not cover:

| Engines having vertical crankshafts | F02B 75/007 |
**F02B 75/007**

{having vertical crankshafts}

**Definition statement**

*This place covers:*

Engines having vertical crankshafts

---

**F02B 75/02**

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

**Definition statement**

*This place covers:*

Engines characterised by their cycles, e.g. six-stroke.
F02B 75/04
Engines with variable distances between pistons at top dead-centre positions and cylinder heads

Definition statement

This place covers:

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

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

<table>
<thead>
<tr>
<th>Valve operation</th>
<th>F01L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling engines with variable distances between piston and cylinder head</td>
<td>F02D</td>
</tr>
</tbody>
</table>
F02B 75/041
{by means of cylinder or cylinderhead positioning}

Definition statement
This place covers:
Engines characterised by means of cylinder or cylinder head positioning; E.g.:

U.S. Patent  Nov. 20, 1979  Sheet 3 of 7  4,174,683
F02B 75/044
(by means of an adjustable piston length)

Definition statement

*This place covers:*

Engines characterised by means of an adjustable piston length; E.g.:
F02B 75/045
{by means of a variable connecting rod length}

Definition statement

This place covers:

Engines characterised by means of a variable connecting rod length; E.g.:
F02B 75/047
{by means of variable crankshaft position}

Definition statement
This place covers:
Engines characterised by means of variable crankshaft position; E.g.:
**F02B 75/048**

{by means of a variable crank stroke length}

**Definition statement**

*This place covers:*

Engines characterised by means of a variable crank stroke length; E.g.:

**F02B 75/06**

Engines with means for equalising torque (compensations of inertial forces, suppression of vibration in systems **F16F**)

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Compensation of inertial forces, suppression of vibration in systems | **F16F** |
F02B 75/065
{with double connecting rods or crankshafts}

Definition statement
This place covers:
Engines with double connecting rods or crankshafts; E.g.:
**F02B 75/08**

Engines with means for preventing corrosion in gas-swept spaces

**Definition statement**

*This place covers:*

Engines with means for preventing corrosion in gas-swept spaces

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

Running faces of engine cylinders; cylinder liners  
F16J 10/04

**F02B 75/10**

Engines with means for rendering exhaust gases innocuous (apparatus per se F01N)

**Definition statement**

*This place covers:*

Engines with means for rendering exhaust gases innocuous.

**References**

*Limiting references*

This place does not cover:

Apparatus for purifying, rendering innocuous or otherwise treating exhaust  
F01N 3/00

Control of combustion engines  
F02D
F02B 75/1896
{with two or more pistons connected to one crank and having a common combustion space}

Definition statement

This place covers:
Engines with two or more pistons connected to one crank and having a common combustion space;
E.g.:
F02B 75/20

with cylinders all in one line

Definition statement

This place covers:

Illustrative example of subject matter classified in this group:
**F02B 75/22**

with cylinders in V, fan, or star arrangement

**Definition statement**

*This place covers:*

Engines with cylinders in V, fan, or star arrangement
F02B 75/221
{with cylinder banks in narrow V-arrangement, having a single cylinder head}

Definition statement

*This place covers:*

Engines with cylinder banks in narrow V-arrangement, having a single cylinder head.
F02B 75/222
{with cylinders in star arrangement}

Definition statement

This place covers:
Engines with cylinders in star arrangement; E.g.:
F02B 75/224
{with cylinders in fan arrangement}

Definition statement

This place covers:
Engines with cylinders in fan arrangement
F02B 75/225
{having two or more crankshafts}

Definition statement

This place covers:
Engines having two or more crankshafts
**F02B 75/227**

{with cylinder banks in X-arrangement, e.g. double-V engines}

**Definition statement**

This place covers:
Engines with cylinder banks in X-arrangement, e.g. double-V engines
F02B 75/228
{with cylinders arranged in parallel banks}

Definition statement

This place covers:
Engines with cylinders arranged in parallel banks
F02B 75/243
{with only one crankshaft of the "boxer" type, e.g. all connecting rods attached to separate crankshaft bearings}

Definition statement

This place covers:

Engines with only one crankshaft of the "boxer" type, e.g. all connecting rods attached to separate crankshaft bearings
F02B 75/246
{with only one crankshaft of the "pancake" type, e.g. pairs of connecting rods attached to common crankshaft bearing}

Definition statement
This place covers:
Engines with only one crankshaft of the "pancake" type, e.g. pairs of connecting rods attached to common crankshaft bearing
**F02B 75/26**

Engines with cylinder axes coaxial with, or parallel or inclined to, main-shaft axis; Engines with cylinder axes arranged substantially tangentially to a circle centred on main-shaft axis

**Definition statement**

*This place covers:*

Engines with cylinder axes coaxial with, or parallel or inclined to, main-shaft axis; Engines with cylinder axes arranged substantially tangentially to a circle centered on main-shaft axis

**References**

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Reciprocating-piston machines or engines with cylinder axes coaxial with, parallel or inclined to, main shaft axis
F02B 75/265

{Engines with cylinder axes substantially tangentially to a circle centred on main-shaft axis}

Definition statement

This place covers:
Engines with cylinder axes substantially tangentially to a circle centred on main-shaft axis
F02B 75/28
Engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders (arranged oppositely relative to main shaft F02B 75/24)

Definition statement
This place covers:
Engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders

References

Limiting references
This place does not cover:

Multi-cylinder engines with cylinders arranged oppositely relative to main shaft F02B 75/24

Informative references
Attention is drawn to the following places, which may be of interest for search:

Engines with with oppositely reciprocating pistons F01B 7/02
F02B 75/282
{the pistons having equal strokes}

Definition statement
This place covers:
Engines with pistons having equal strokes

Figure 1
**F02B 75/285**

{comprising a free auxiliary piston}

**Definition statement**

*This place covers:*

Engines comprising a free auxiliary piston
**F02B 75/287**

{with several pistons positioned in one cylinder one behind the other}

**Definition statement**

*This place covers:*

Engines with several pistons positioned in one cylinder one behind the other
**F02B 75/30**

with one working piston sliding inside another

**Definition statement**

*This place covers:*

Engines with one working piston sliding inside another

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**F02B 75/32**

Engines characterised by connections between pistons and main shafts and not specific to preceding main groups

**Definition statement**

*This place covers:*

This subgroup contains all mechanisms between pistons and main shafts not otherwise described in more pertinent classes.
This example is for an engine with pulled con-rods during working stroke.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Details for the given mechanism connecting pistons and main shafts | F01B |
F02B 75/34
Ultra-small engines, e.g. for driving models

Definition statement
This place covers:
Ultra-small engines, e.g. for driving models

ANY "SMALL" ENGINE; MINIATURE CO2 ENGINES; COMPRESSED AIR ENGINES.

Cycles possible: DIESEL, GLOW IGN., SPARK ign.

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Homogeneous Charge Compression Ignition | F02B 1/12 |
| For steam or compressed air drive mechanism for toys | A63H 29/16 |
| Compressed air engines | F01B 17/00 |

Synonyms and Keywords
In patent documents the following expressions/words "diesel", "glowplug", "c-methanol", "castor oil", "nitro methane" and "amyl nitrate" are often used.
F02B 75/36
Engines with parts of combustion- or working-chamber walls resiliently yielding under pressure

Definition statement
This place covers:
Engines with parts of combustion- or working-chamber walls resiliently yielding under pressure
F02B 75/38
Reciprocating - piston engines (F02B 75/04 takes precedence; with resiliently-urged auxiliary piston in pre-combustion chamber F02B 19/06)

Definition statement
This place covers:
Reciprocating piston engines. E.g.:

References
Limiting references
This place does not cover:

| Engines with resiliently-urged auxiliary piston in pre-combustion chamber | F02B 19/06 |
| Engines with variable distances between pistons at top dead-centre positions and cylinder heads | F02B 75/04 |

F02B 75/40
Other reciprocating-piston engines

Definition statement
This place covers:
Other reciprocating-piston engines
**F02B 77/00**

**Component parts, details or accessories, not otherwise provided for**

**Definition statement**

This place covers:

These groups covers component parts, details or accessories, not otherwise provided for. E.g. freeze plugs, thermal or acoustic insulation etc.

**F02B 77/02**

**Surface coverings of combustion-gas-swept parts (of pistons or cylinders only F02F)**

**References**

**Limiting references**

This place does not cover:

| Surface coverings of pistons or cylinders only | F02F |
F02B 77/04
Cleaning of, preventing corrosion or erosion in, or preventing unwanted deposits in, combustion engines {(cleaning of fuel injection apparatus F02M 65/00)}

Definition statement
This place covers:
Any cleaning of engines, decarbonising, de-coking.

References
Limiting references
This place does not cover:

| Cleaning of fuel injection apparatus       | F02M 65/00 |

F02B 77/08
Safety, indicating or supervising devices (thermal insulation F02B 77/11; {rendering engines inoperative or idling F02D 17/04; dependent on lubricating conditions F01M 1/22; dependent on cooling F01P 11/14})

Definition statement
This place covers:
Indicating and warning devices.
References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Thermal insulation                          | F02B 77/11 |
| Rendering engines inoperative or idling on lubricant pressure failure | F01M 1/22 |
| Indicating or safety devices relating to cooling | F01P 11/14 |
| Control of combustion engines               | F02D       |
| Rendering engines inoperative or idling     | F02D 17/04 |

F02B 77/081

{relating to endless members (endless members, e.g. belts, for driving auxiliary apparatus F02B 67/04)}

Definition statement

This place covers:
Safety, indicating or supervising devices relating to endless members

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Endless members, e.g. belts, for driving auxiliary apparatus | F02B 67/04 |
F02B 77/082
{relating to valves}

Definition statement

This place covers:
Safety, indicating or supervising devices relating to valves
F02B 77/083
{relating to maintenance, e.g. diagnostic device (relating to lubrication F01M 11/10)}

Definition statement

This place covers:
Safety, indicating or supervising devices relating to maintenance, e.g. diagnostic device

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

| Indicating and safety devices concerning lubricant level | F01M 11/10 |
F02B 77/084
{indicating economy}

Definition statement

This place covers:

Safety, indicating or supervising devices indicating economy
F02B 77/085
{with sensors measuring combustion processes, e.g. knocking, pressure, ionization, combustion flame}

Definition statement
This place covers:
Safety, indicating or supervising devices with sensors measuring combustion processes, e.g. knocking, pressure, ionization, combustion flame

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Control of combustion engines | F02D |
F02B 77/086

{Sensor arrangements in the exhaust, e.g. for temperature, misfire, air/fuel ratio, oxygen sensors}

Definition statement

This place covers:
Sensor arrangements in the exhaust, e.g. for temperature, misfire, air/fuel ratio, oxygen sensors

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Using sensors in exhaust for controlling combustion engine  F02D 41/00
**F02B 77/087**

{determining top dead centre or ignition-timing}

**Definition statement**

*This place covers:*

Safety, indicating or supervising devices determining top dead centre or ignition-timing

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

| Controlling combustion engines | F02D |
**F02B 77/088**

{relating to tightness}

**Definition statement**

This place covers:

Safety, indicating or supervising devices relating to tightness

![Diagram](image)

**F02B 77/089**

{relating to engine temperature (concerning coolant temperature F01P 11/16)}

**References**

**Informative references**

Attention is drawn to the following places, which may be of interest for search:

| Indicating and safety devices concerning coolant temperature | F01P 11/16 |
F02B 77/10
Safety means relating to crankcase explosions

Definition statement
This place covers:
Safety means relating to crankcase explosions

F02B 77/11
Thermal or acoustic insulation

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Thermal insulation in general | F16L 59/00 |

F02B 77/13
Acoustic insulation

References
Informative references
Attention is drawn to the following places, which may be of interest for search:

| Sound insulation of engine casings, e.g. crankcases | F02F 7/008 |
**F02B 77/14**

**Engine-driven auxiliary devices combined into units**

**Definition statement**

*This place covers:*

Engine-driven auxiliary devices combined into units: E.g. a water pump and an alternator combined in one unit.

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**F02B 79/00**

**Running-in of internal-combustion engines (lubrication thereof F01M)**

**Definition statement**

*This place covers:*

Running-in of internal-combustion engines.

**References**

*Informative references*

Attention is drawn to the following places, which may be of interest for search:

| Lubrication of internal combustion engines | F01M |