

F02B

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

Limiting references

This place does not cover:

Gas-turbine plants	F02C
Hot-gas or combustion-product positive-displacement engine plants	F02G

Informative references

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

Apparatus for generating fuel, e.g. gas, see the relevant classes, e.g.	C10
Rotary-piston or oscillating-piston	F01C
Non-positive-displacement type	F01D
Steam engines plants	F01K
Cyclically operating valves for machines or engines	F01L
Lubrication of machines or engines in general	F01M
Exhaust Apparatus	F01N
Cooling of Engines	F01P
Controlling combustion engines	F02D

Carburettors, fuel-injection apparatus	F02M
Crankshafts, crossheads, connecting-rods	F16C
Flywheels	F16F
Gearings for interconverting rotary motion and reciprocating motion in general	F16H
Pistons, piston rods, cylinders for engines in general	F16J

Glossary of terms

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

engine	a device for continuously converting fluid energy into mechanical power. Thus, this term includes, for example, steam piston engines or steam turbines, per se, or internal-combustion piston engines, but it excludes single-stroke devices. "Engine" also includes the fluid-motive portion of a meter unless such portion is particularly adapted for use in a motor;
pump	a device for continuously raising, forcing, compressing, or exhausting fluid by mechanical or other means. Thus, this term includes fans or blowers;
machine	a device which could equally be an engine and a pump, and not a device which is restricted to an engine or one which is restricted to a pump;
positive displacement	the way the energy of a working fluid is transformed into mechanical energy, in which variations of volume created by the working fluid in a working chamber produce equivalent displacements of the mechanical member transmitting the energy, the dynamic effect of the fluid being of minor importance, and vice versa ;
non-positive displacement	the way the energy of a working fluid is transformed into mechanical energy, by transformation of the energy of the working fluid into kinetic energy, and vice versa ;
oscillating-piston machine	a positive-displacement machine in which a fluid-engaging work-transmitting member oscillates. This definition applies also to engines and pumps;
rotary-piston machine	a positive-displacement machine in which a fluid-engaging work-transmitting member rotates about a fixed axis or about an axis moving along a circular or similar orbit. This definition applies also to engines and pumps;
rotary piston	the work-transmitting member of a rotary-piston machine and may be of any suitable form, e.g., like a toothed gear;
cooperating members	the "oscillating piston" or "rotary piston" and another member, e.g., the working-chamber wall, which assists in the driving or pumping action;
movement of the co-operating members	is to be interpreted as relative, so that one of the "co-operating members" may be stationary, even though reference may be made to its rotational axis, or both may move;
teeth or tooth equivalents	include lobes, projections or abutments;

internal-axis type	that the rotational axes of the inner and outer co-operating members remain at all times within the outer member, e.g., in a similar manner to that of a pinion meshing with the internal teeth of a ring gear;
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](#))

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:

Characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition	F02B 11/00
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Informative references

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

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

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

HCCI	Homogeneous Charge Compression Ignition
PCCI	Premixed Charge Compression Ignition

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:

Direct injection petrol engines	F02B 2075/125
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F02B 1/06

Methods of operating

References

Informative references

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

Controlling engines	F02D
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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:

With compression ignition	F02B 1/12
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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
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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:

HCCI	Homogeneous Charge Compression Ignition
PCCI	Premixed Charge Compression Ignition

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](#))

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
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Informative references

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

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

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
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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

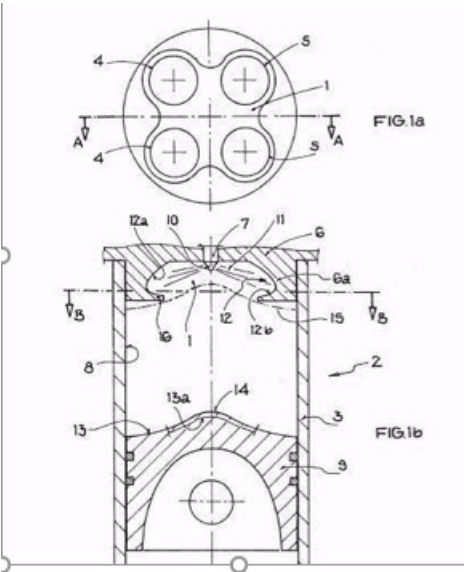
F02B 3/06

with compression ignition (compression ignition engines using air or gas for blowing fuel into compressed air in cylinder [F02B 13/02](#))

Definition statement

This place covers:

In short: The Diesel engine. Preferably only deviations of the Diesel engine should be classified here.



References

Limiting references

This place does not cover:

Engines with positive injection	F02B 13/02
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Informative references

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

Engines with fuel-air charge ignited by compression ignition of an additional fuel	F02B 7/00
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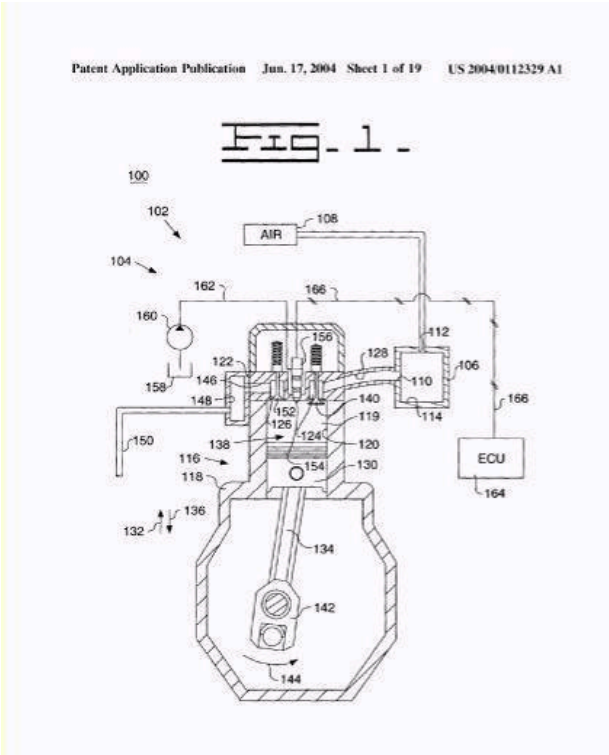
F02B 3/08

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
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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
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Fuel injection apparatus with each cyclic delivery being separated into two or more parts	F02M 45/02
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F02B 5/00

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

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
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

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 5/02

Methods of operating

References

Limiting references

This place does not cover:

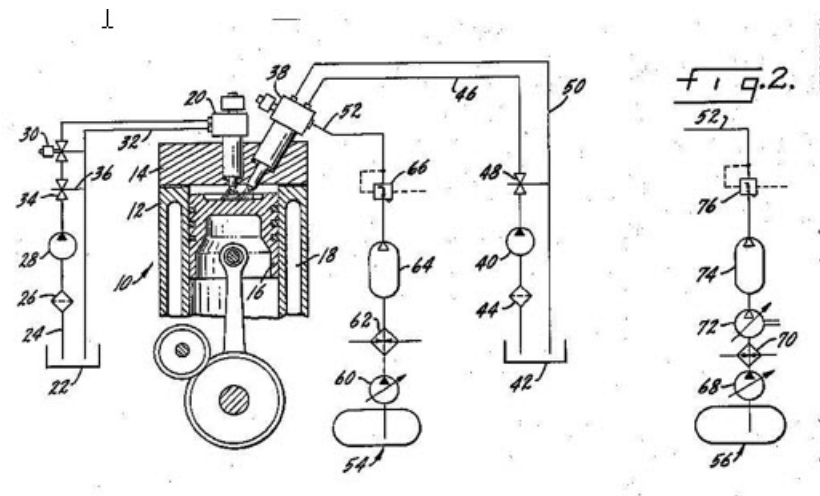
Control of combustion engines	F02D
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F02B 7/00

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](#))

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

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	F02B 11/00
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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

Glossary of terms

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

Pilot injection	The injection of an additional fuel for ignition of a compressed fuel-air mixture
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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](#))

Definition statement

This place covers:

Engines characterised by other types of ignition.

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	F02B 11/00
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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

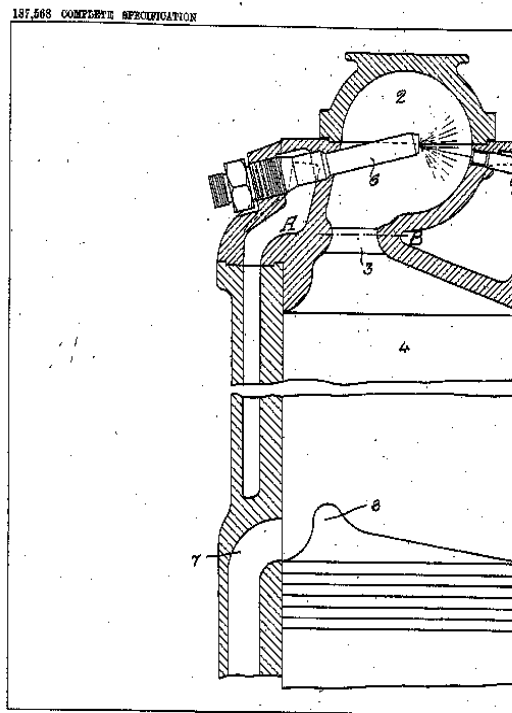
F02B 9/08

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

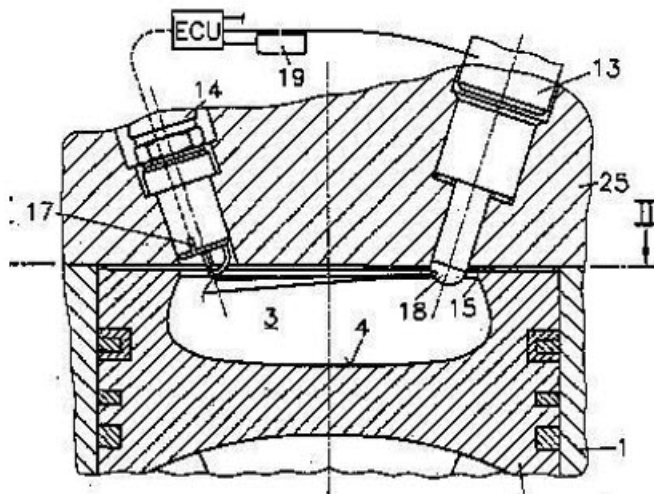
Definition statement

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

Definition statement

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
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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:

Direct injection	F02B 2075/125
Indirect injection	F02M

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
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Informative references

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

Combustion chambers (shape)	F02B 23/00
Modifying induction systems for imparting a rotation to the charge in the cylinder	F02B 31/00
Electrical control of supply of combustible mixture or its constituents	F02D 41/00

Cylinder heads (shape)	F02F 1/00
Pistons	F02F 3/00

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:

Stratification	Layers of air and fuel
Charge	Air and/or fuel contents in cylinder

F02B 19/00

Engines characterised by precombustion chambers

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

Indirect injection diesel engine. Multi fuel engines. Lean burn engines. Gas engines.

References

Informative references

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

Engines with fuel air mixture compression	F02B 1/00
Engines with incandescent chambers	F02B 9/08
Engines with air storage cambers	F02B 21/00
Engines with special shape of combustion chamber	F02B 23/00
Cylinders; Cylinder heads	F02F 1/00
Sparking plugs in partly enclosed ignition chamber	H01T 13/54

Glossary of terms

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

Incandescent chamber	Chamber with hot spot
Torch passage	Passage between pre- and main combustion chamber
Squish area	Compressed area between piston top and cylinder head
Air swirl	Rotational movement of air

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:

Air hybrid prime movers	B60K 6/08
Compressed air driven engines	F01B 29/08

Informative references

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

Cylinders; cylinder heads	F02F 1/00
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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:

Auxiliary chamber	Chamber not being a combustion chamber
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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

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

Informative references

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

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

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

Informative references

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

Modifying induction systems	F02B 31/00
Aspects characterized by provision of driven charging or scavenging pumps	F02B 33/00 - F02B 39/00
Use of driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge	F02B 33/42
Exhaust silencing apparatus	F01N 1/00

Glossary of terms

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

Resonance charging	Oscillating air column charging
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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 29/02

Other fluid-dynamic features of induction systems for improving quantity of charge (for also imparting a rotation to the charge in the cylinder [F02B 31/00](#))

References

Limiting references

This place does not cover:

for also imparting a rotation to the charge in the cylinder	F02B 31/00
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Informative references

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

Air intakes; Induction systems for internal-combustion engines	F02M 35/10
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F02B 29/04**Cooling of air intake supply****References****Informative references**

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

Arrangement or mounting of liquid cooling devices in vehicles	B60K 11/04
Liquid cooling circuits not specific to a single part of internal combustion engine	F01P 3/20

F02B 29/08**Modifying distribution valve timing for charging purposes ([F02B 29/06](#) takes precedence)****References****Limiting references**

This place does not cover:

After-charging, i.e. supplementary charging after scavenging	F02B 29/06
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Informative references

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

Valve-gear therefor	F01L
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F02B 31/00**Modifying induction systems for imparting a rotation to the charge in the cylinder (air intakes or induction systems for internal-combustion engines [F02M 35/10](#))****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:

Air induction systems structural features	F02M 35/10
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Informative references

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

Shape of combustion chamber	F02B 23/00
Lift valves	F01L 3/00
Cylinders, cylinder heads	F02F 1/00

Glossary of terms

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

Swirl	Rotation around cylinder axis
Tumble	Rotation around transverse cylinder axis

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

Definition statement

This place covers:

Engines characterised by provision of pumps for charging or scavenging.

Relationships with other classification places

Turbochargers per se are classified in [F02C 6/12](#).

References

Informative references

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

Characterised by introducing fuel into cylinders by auxiliary fluid, e.g. by air-pressure	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
Arrangements of such pumps or other auxiliary apparatus on engines	F02B 67/00

Combined engine and pump control, control dependent on variables other than those generic to pumps	F02D
Cylinders characterised by having ports in cylinder for scavenging or charging	F02F 1/22
Pumps per se	F04

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

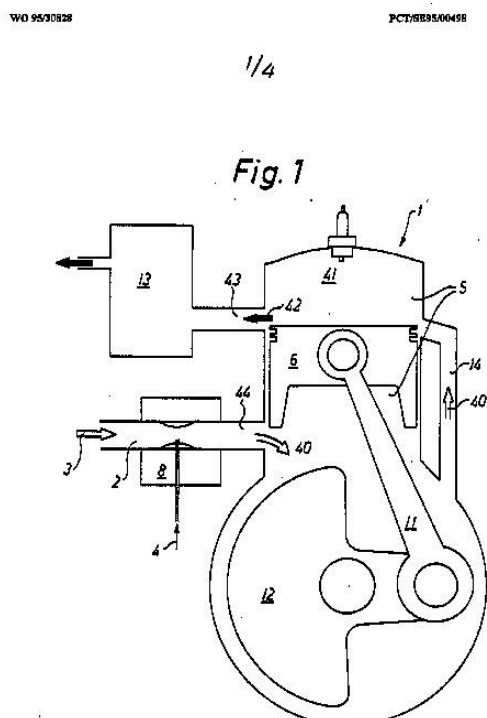
Attention is drawn to the following places, which may be of interest for search:

Cylinders characterised by having ports in cylinder for scavenging or charging	F02F 1/22
--	---------------------------

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.

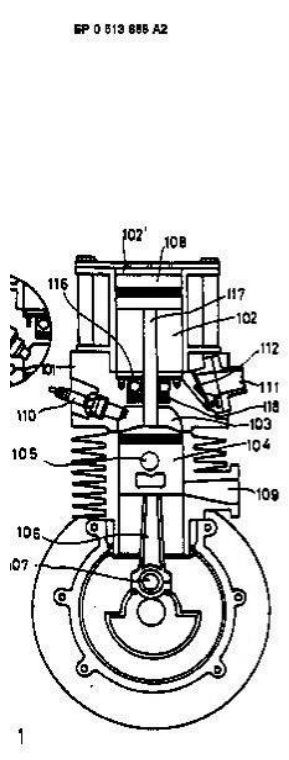
F02B 33/08

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](#)

E.g.:

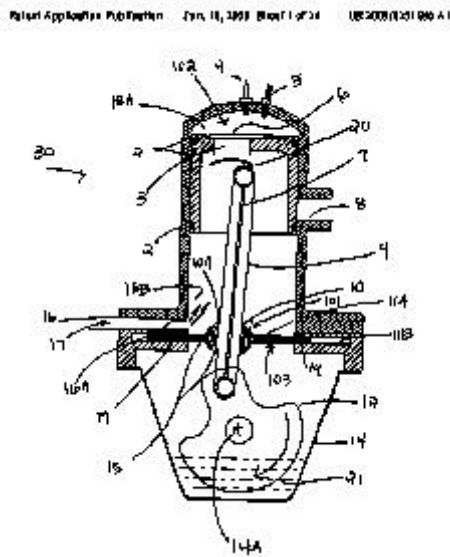
**F02B 33/12**

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.:

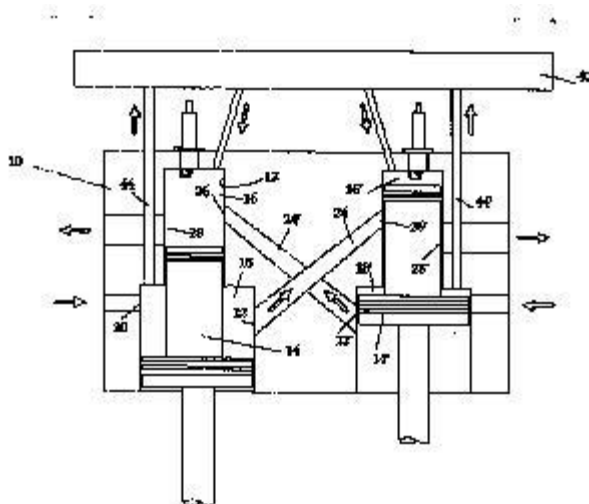


F02B 33/14

working and pumping pistons forming stepped piston

Special rules of classification

Illustrative example of subject matter classified in [F02B 33/14](#)

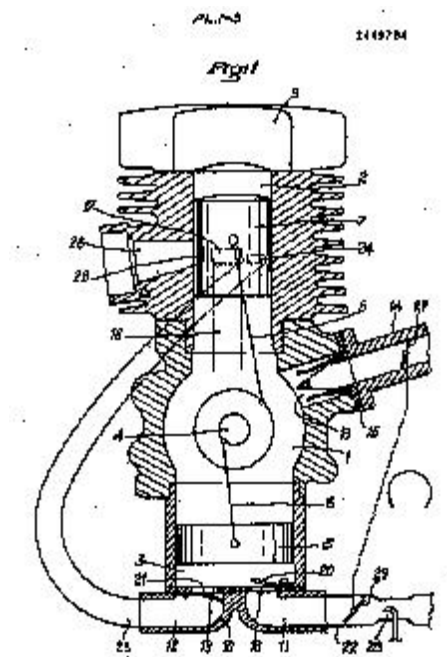


F02B 33/18

with crankshaft being arranged between working and pumping cylinders

Special rules of classification

Illustrative example of subject matter classified in [F02B 33/18](#)

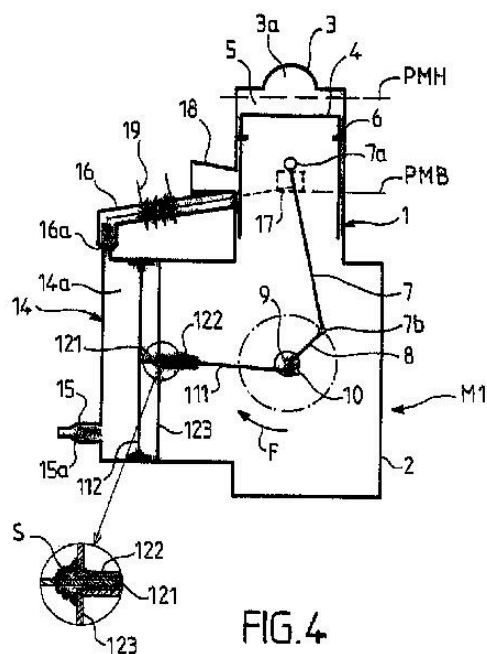
**F02B 33/20**

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.:



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F02B 33/22

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

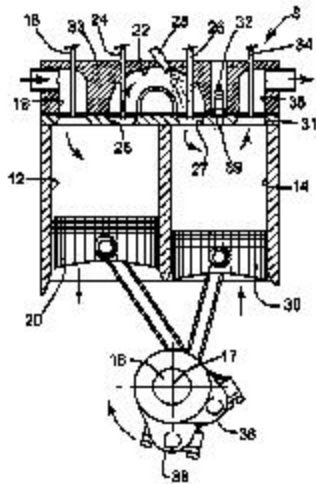
Special rules of classification

Illustrative example of subject matter classified in [F02B 33/22](#)

E.g.:

Fig. 1
Prior Art

FIG. 1
Prior Art



F02B 33/26

Four-stroke engines characterised by having crankcase pumps

Special rules of classification

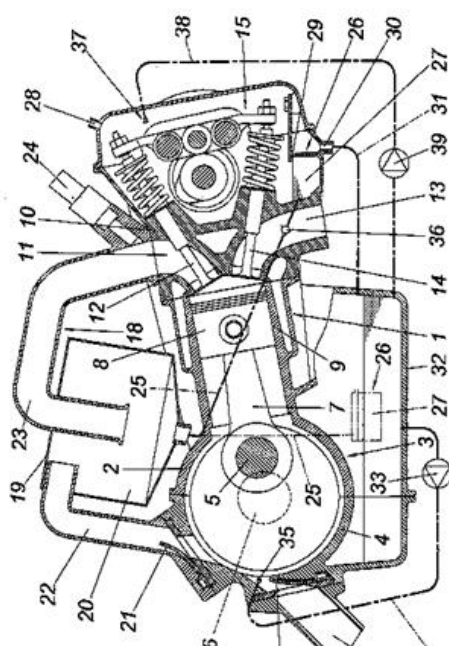
Illustrative example of subject matter classified in [F02B 33/26](#)

E.g.:

WO 2006/097615

PCT/AT2006/000257

1/1



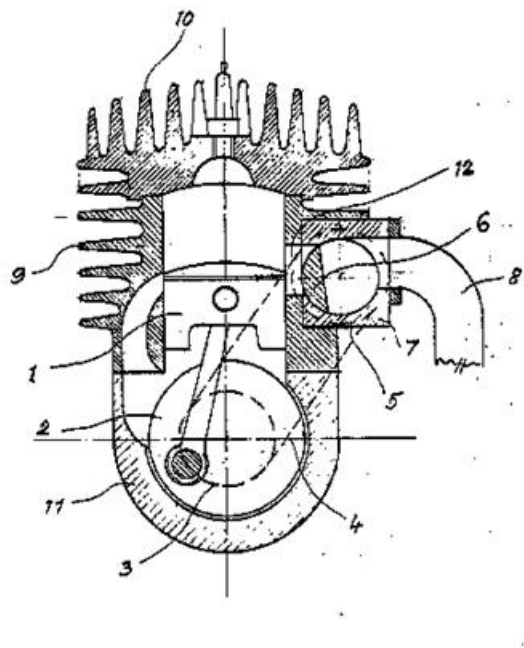
F02B 33/30

Control of inlet or outlet ports

Definition statement

This place covers:

Illustrative example of subject matter classified in this group.



References

Informative references

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

Controlling only working-cylinder inlets	F01L
--	----------------------

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

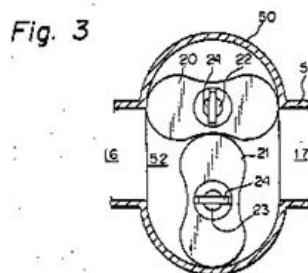
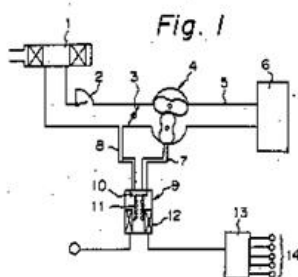
of Roots type

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 4,594,5

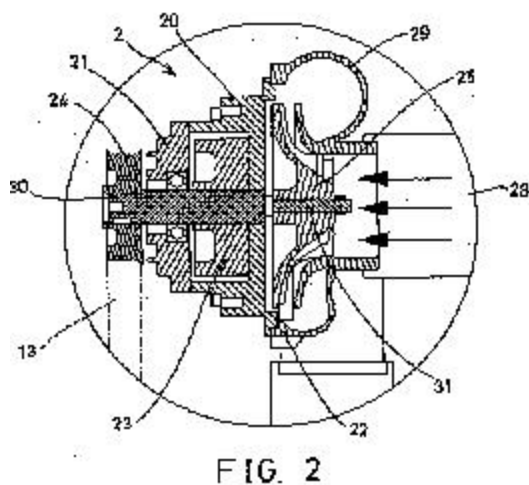
**F02B 33/40**

of non-positive-displacement type

Special rules of classification

Illustrative example of subject matter classified in [F02B 33/40](#)

E.g.:



Patent Application Publication Dec. 18, 2008 Sheet 2 of 7 US 2008/0248078 A1

F02B 33/42

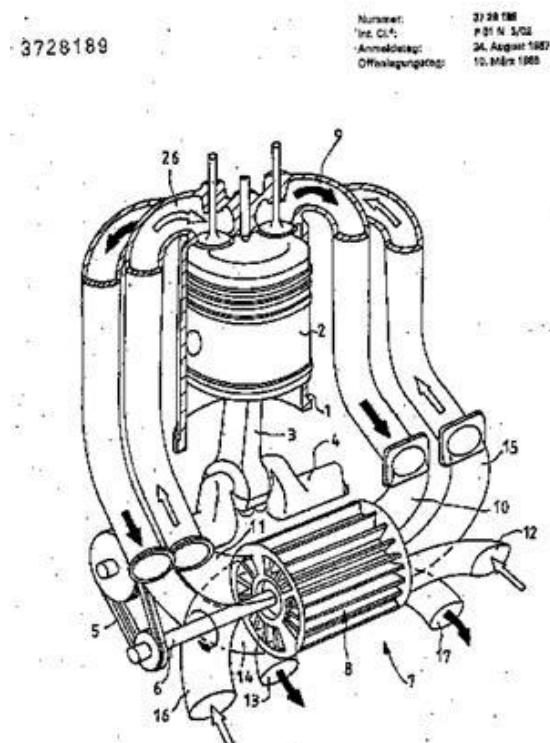
with driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge, e.g. with cell-type pressure exchangers

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

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:

After-charging	F02B 29/06
Arrangements of such pumps or other auxiliary apparatus on engines	F02B 67/00
Combined engine and pump control, control dependent on variables other than those generic to pump	F02D

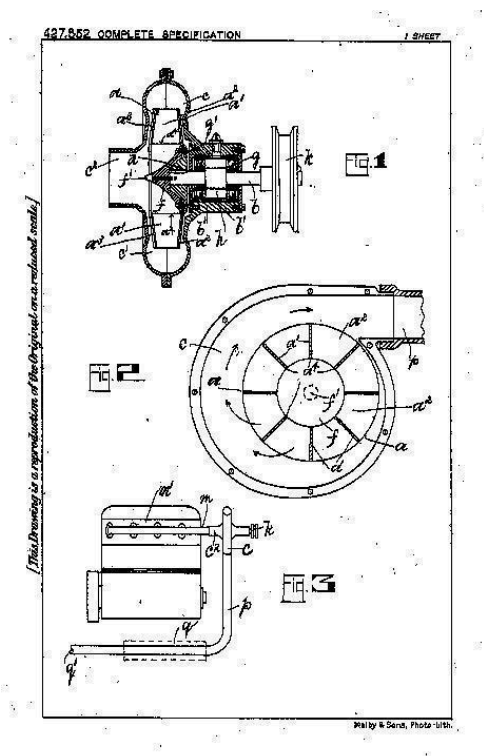
F02B 35/02

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

Definition statement

This place covers:

Engines with turbocharging.

Relationships with other classification places

Turbochargers per se are classified in [F02C 6/12](#).

References

Informative references

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

Engines 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
Turbo-compound	F02B 41/10
Arrangements of such pumps or other auxiliary apparatus on engines	F02B 67/00
Details or constructional aspects of turbines per se	F01D 17/00
Constructional aspects of bypass valves in turbochargers	F01D 17/10
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
Combined engine and pump control, control dependent on variables other than those generic to pump	F02D
Pumps	F04
Constructional aspects of pumps	F04C
Controls of pumps	F04D 15/00
Valves in general	F16K

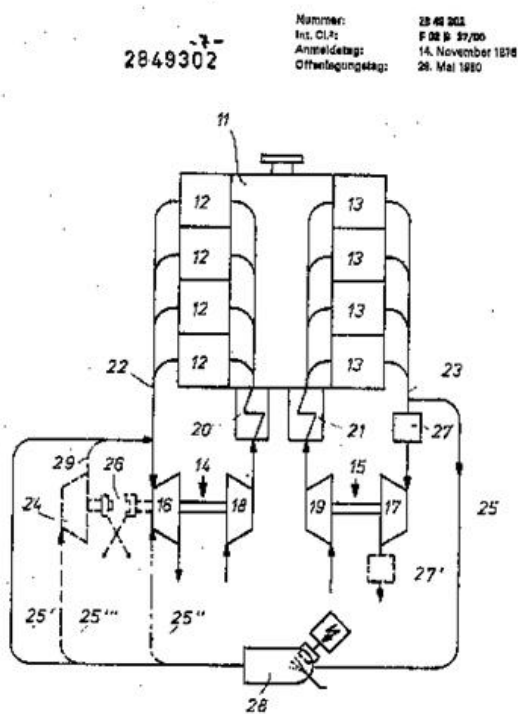
F02B 37/007

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.:

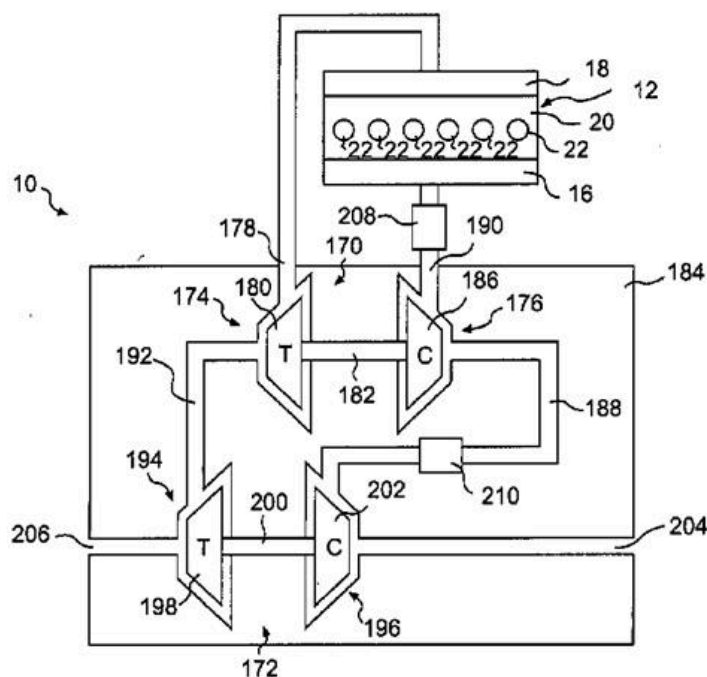


FIG. 1

Patent Application Publication Nov. 3, 2005 Sheet 1 of 9
US 2005/0241611 A1

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

Informative references

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

Details or constructional aspects of turbines	F01D
Final actuators for regulating or controlling by varying flow in non-positive displacement machines	F01D 17/10

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
------------------	----------------------------

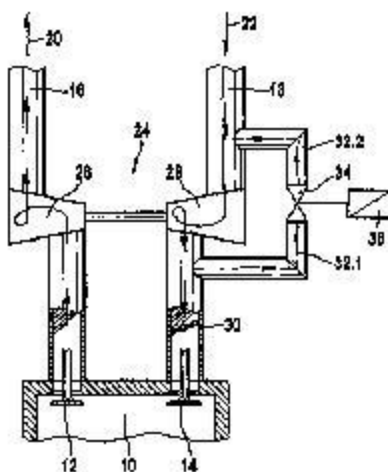
F02B 37/16

by bypassing charging air

Definition statement

This place covers:

Illustrative example of subject matter classified in [F02B 37/16](#)



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:

By using pumps or turbines with adjustable guide vanes	F02B 37/24
--	----------------------------

Informative references

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

Constructional aspects per se of such devices	F01D 17/14
---	----------------------------

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

Informative references

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

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
Arrangements of such pumps or other auxiliary apparatus on engines	F02B 67/00
Details or constructional aspects of turbines	F01D
Combined engine and pump control, control dependent on variables other than those generic to pump	F02D
Pumps	F04
Pumps in general	F04
Machine element per se	F16

F02B 39/005

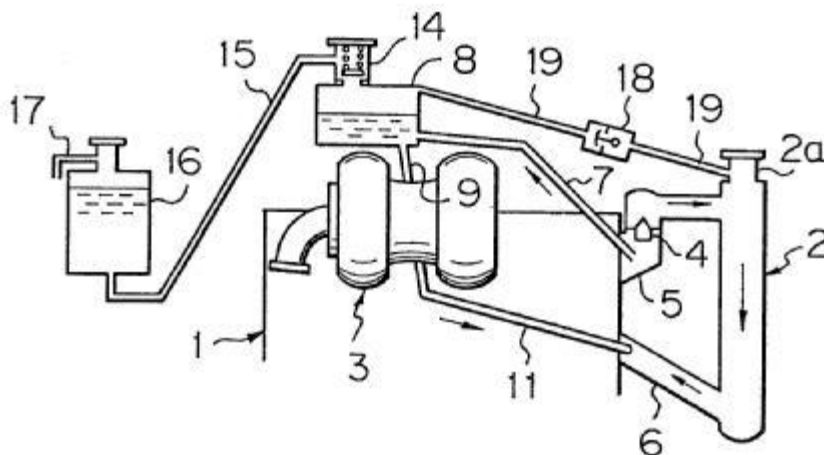
{Cooling of pump drives}

Definition statement

This place covers:

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

See e.g.:



(from ep160243)

References

Limiting references

This place does not cover:

Turbocharger cooling per se, e.g. cooling a turbocharger bearing per se	F01D , F01D 25/125 , F02C 6/12 ,
Cooling of turbochargers	F01D 25/12
Cooling of turbocharger bearings	F01D 25/125
Cooling of turbocharger casing	F01D 25/14
Cooling of machines or engines in general; cooling of internal-combustion engines	F01P

F02B 39/02

Drives of pumps (exhaust drives or combined exhaust and other drives [F02B 37/00](#)); Varying pump drive gear ratio

References

Limiting references

This place does not cover:

Exhaust drives or combined exhaust and other drives	F02B 37/00
---	----------------------------

Informative references

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

Control acting both on engine and on pump drive gear ratio	F02D
--	----------------------

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:

Non-mechanical pump drives having variable gear ratio	F02B 39/08
---	----------------------------

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:

Lubricating of machines or engines in general; lubricating internal-combustion engines	F01M
Turbocharger lubrication per se, e.g. lubricating a turbocharger bearing per se	F02C 6/12 ; F01D 25/18
Lubrication of bearings in general	F16C
Lubricating in general	F16N

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:

Cleaning of turbomachines	F01D 25/002
Cleaning of pumps using liquids	F04D 29/705
Measuring vibration of turbo machines	G01H 1/006

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:

Variable compression ratio	F02B 75/04
Thermal insulation	F02B 77/11 , F02B 77/02
Modified dwell of piston in TDC	F02B 2275/36

F02B 41/02

Engines with prolonged expansion

Glossary of terms

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

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

F02B 41/04

in main cylinders

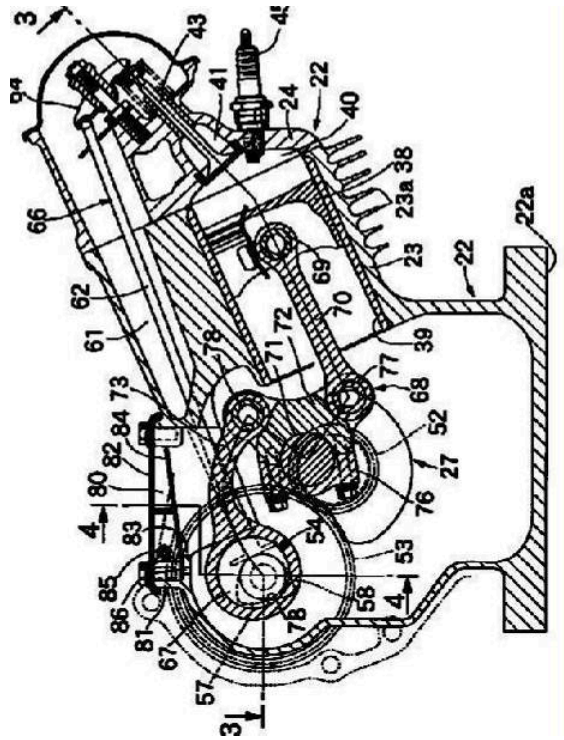
Definition statement

This place covers:

Engines with means and ways to make the compression stroke and the expansion stroke different.

Definition statement

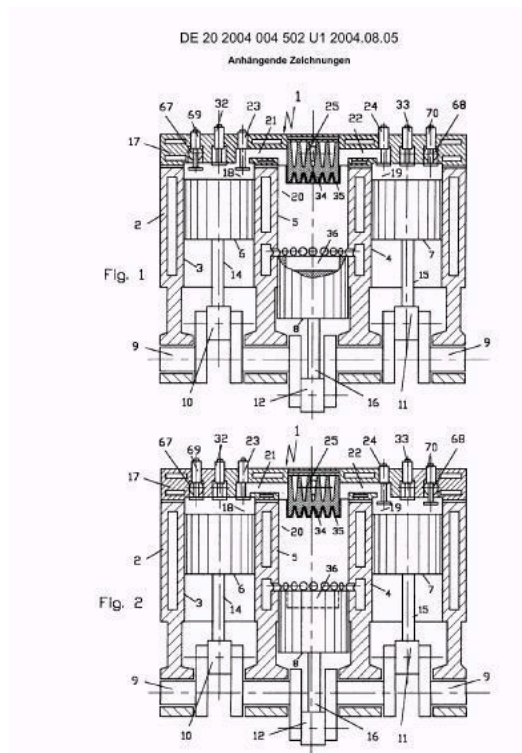
E.g. engines using the Miller or Atkins cycles or using mechanical means in order to have special stroke of piston.



F02B 41/06**in compound cylinders****Definition statement**

This place covers:

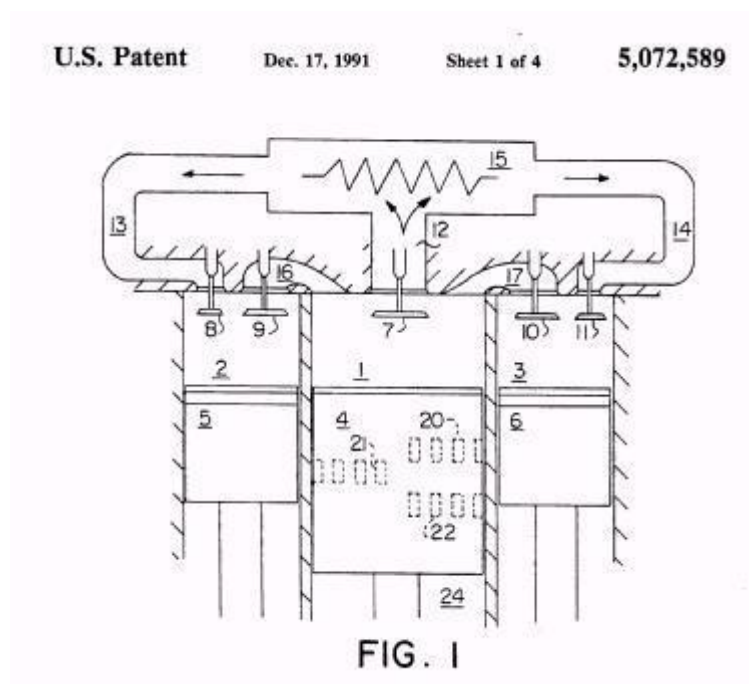
Engines with more than one expansion stroke. I.e. the exhaust is allowed to expand in an additional cylinder. The compounding is similar to the compounding in a steam engine.



F02B 41/08**Two-stroke compound engines****Definition statement**

This place covers:

Two stroke engines with second expansion in an expansion cylinder

**F02B 41/10**

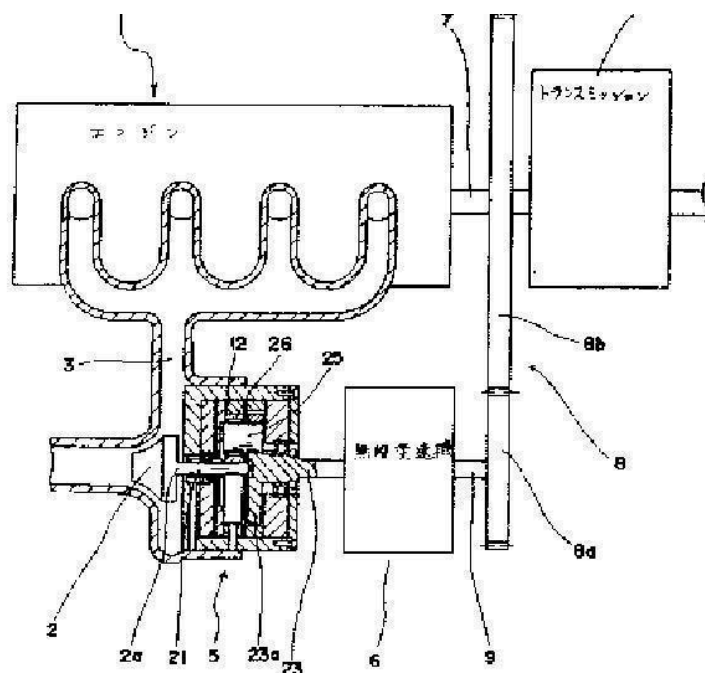
in exhaust turbines (use of exhaust turbines for charging [F02B 37/00](#))

Definition statement

This place covers:

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

Illustrative example of subject matter classified in this group



References

Limiting references

This place does not cover:

Use of exhaust turbines for charging	F02B 37/00
--------------------------------------	----------------------------

Informative references

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

Turbine construction	F01D
----------------------	----------------------

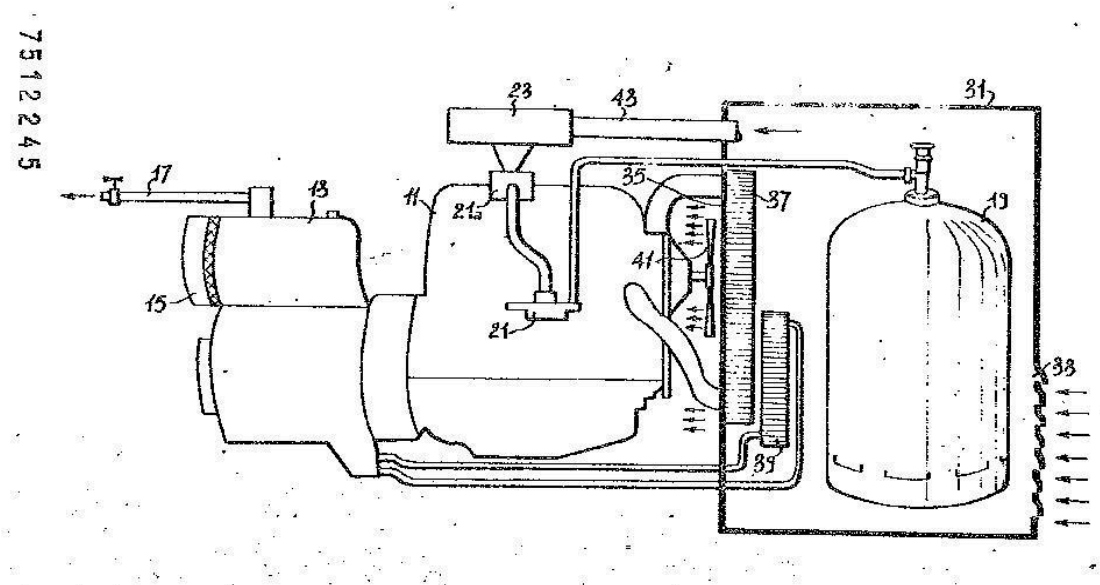
F02B 43/00

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:

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
Control of gas supply per se	F02D 19/00
Installations for supply of gas per se	F02M 21/00

Informative references

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

Control of gas engines	F02D 19/00
Fuel supply apparatuses	F02M 21/00

Glossary of terms

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

LNG	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
LPG	Liquefied Petroleum Gas
CNG	Compressed Natural Gas
DME	Dimethyl ether

F02B 43/10

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

Definition statement

This place covers:

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

References

Limiting references

This place does not cover:

Production of hydrogen	C01B 3/02
Fuel cell per se	H01M 8/00

Informative references

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

Supplying engines with gaseous fuel	F02M 21/02
-------------------------------------	----------------------------

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:

Controlling combustion engines	F02D
--------------------------------	----------------------

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:

Plants involving generation of gaseous fuels from solid fuel	F02B 43/08
Engines convertible from gas to other fuel consumption	F02B 69/04

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
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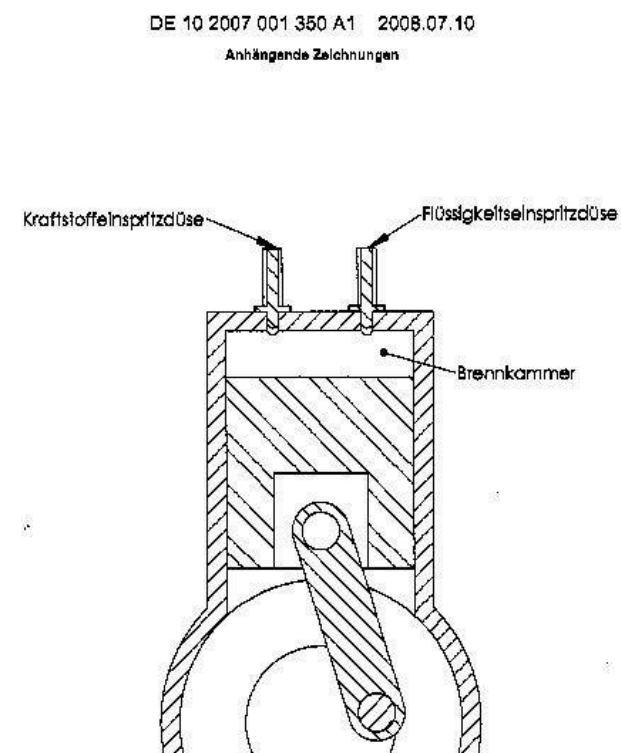
F02B 47/00

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
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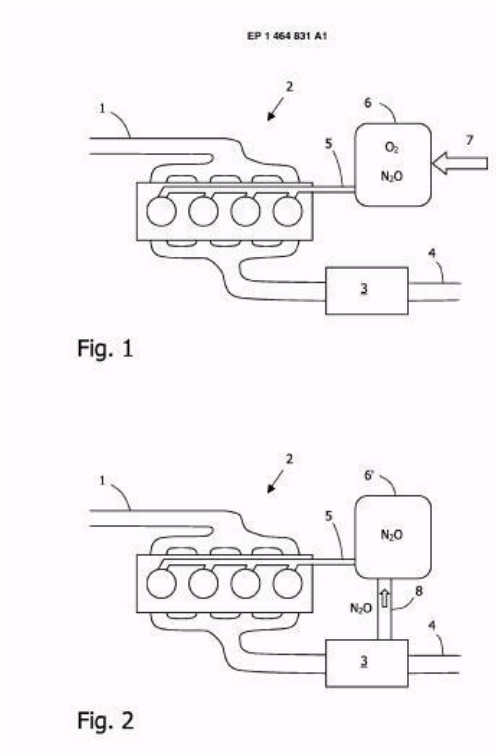
F02B 47/06

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:

Circulation of exhaust gas in closed or semi-closed circuits	F02B 47/10
Apparatus for supplying non-airborne oxygen to engine	F02M 25/10

F02B 47/08

the substances including exhaust gas

References

Limiting references

This place does not cover:

Apparatus for adding exhaust gas to engines	F02M 26/00
---	----------------------------

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
--	----------------------------

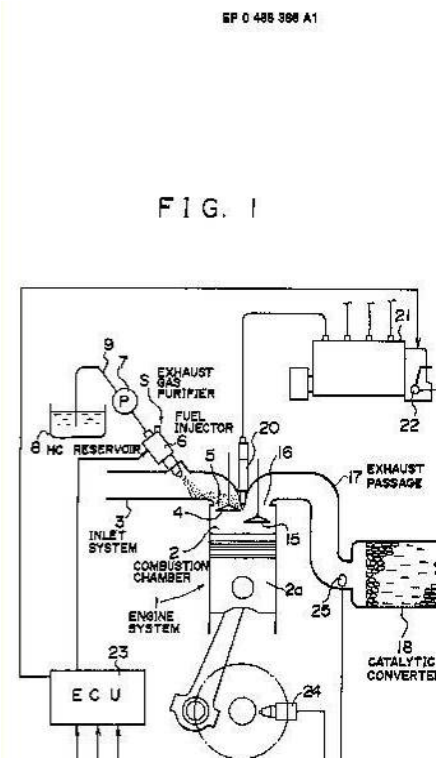
F02B 49/00

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 or 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:

Internal combustion aspects of rotary pistons or outer members of co-operating therewith	F02B 55/00
Rotary-piston machines or engines per se	F01C 1/00 , F01C 3/00 , F01C 5/00 , F01C 7/00
Oscillating-piston machines or engines	F01C 9/00

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:

Rotary-piston machines or engines per se	F01C 1/00 , F01C 3/00 , F01C 5/00 , F01C 7/00
Oscillating-piston machines or engines	F01C 9/00

F02B 55/10

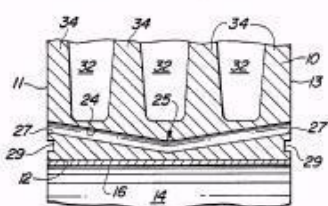
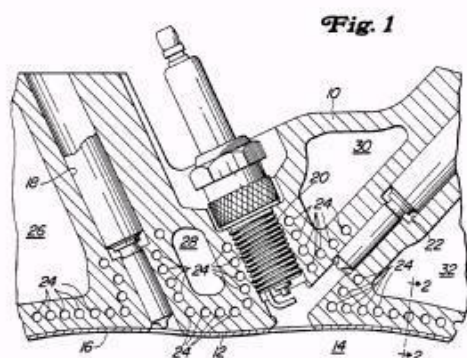
Cooling thereof

Special rules of classification

Illustrative example of subject matter classified in [F02B 55/10](#)

E.g.:

U.S. Patent Jul. 26, 1988 Sheet 1 of 4 4,759,325



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.:

U.S. Patent Oct. 19, 1999 Sheet 1 of 11 5,967,102

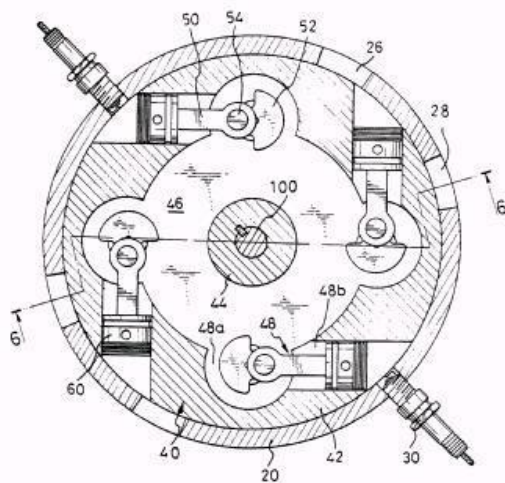


FIG. 1

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 or exhaust control	F02B 57/04
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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
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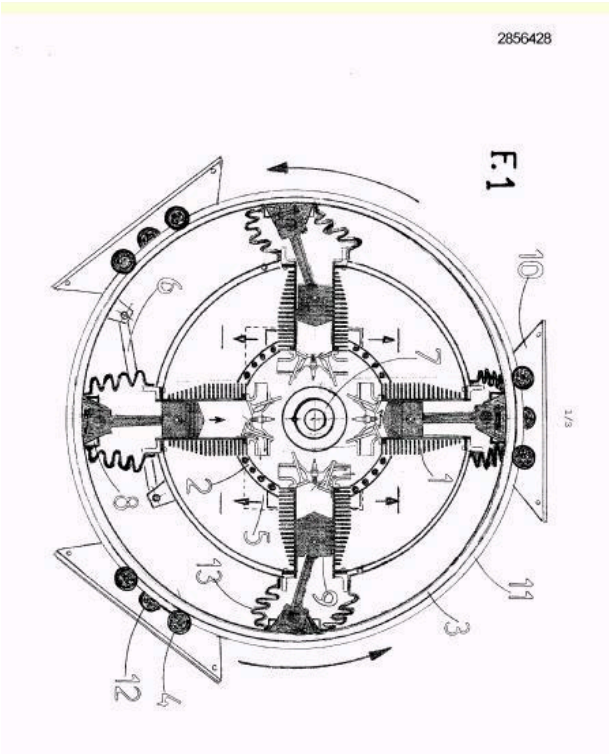
F02B 57/08

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

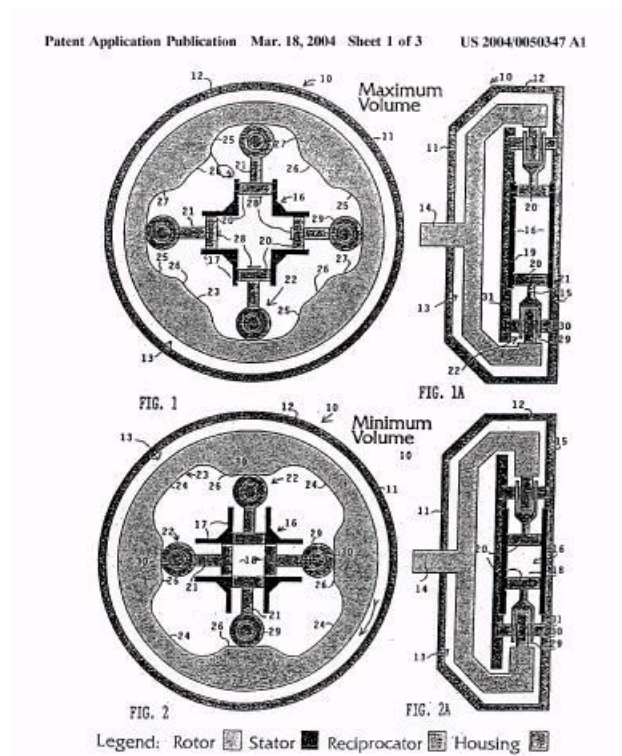
F02B 57/10

with combustion space in centre of star

Definition statement

This place covers:

Engines with combustion space in centre of star, e.g.:



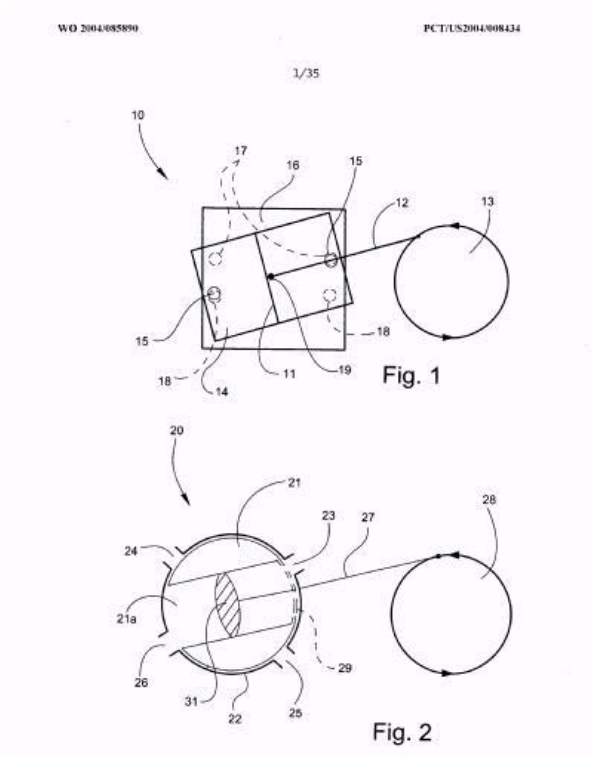
F02B 59/00

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
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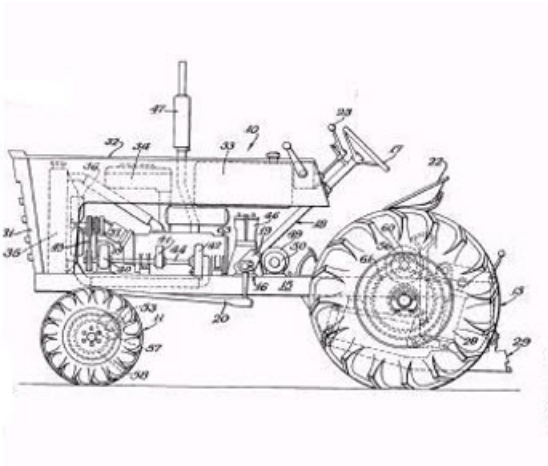
F02B 61/00

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](#))

Definition statement

This place covers:
Adaptations of engines for driving vehicles or for driving propellers; Combinations of engines with gearing.

Illustrative example of subject matter classified in this group:



References

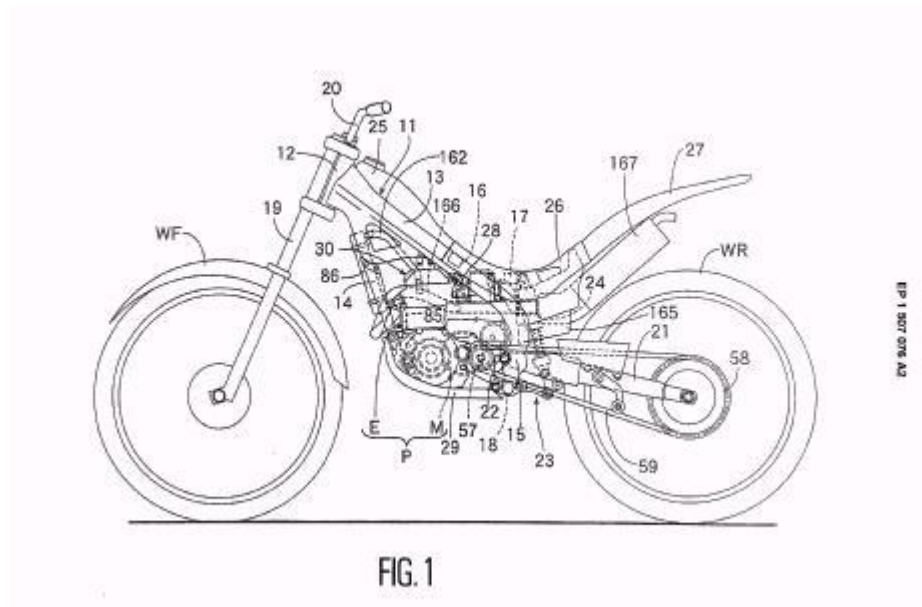
Limiting references

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

F02B 61/02**for driving cycles****Definition statement***This place covers:*

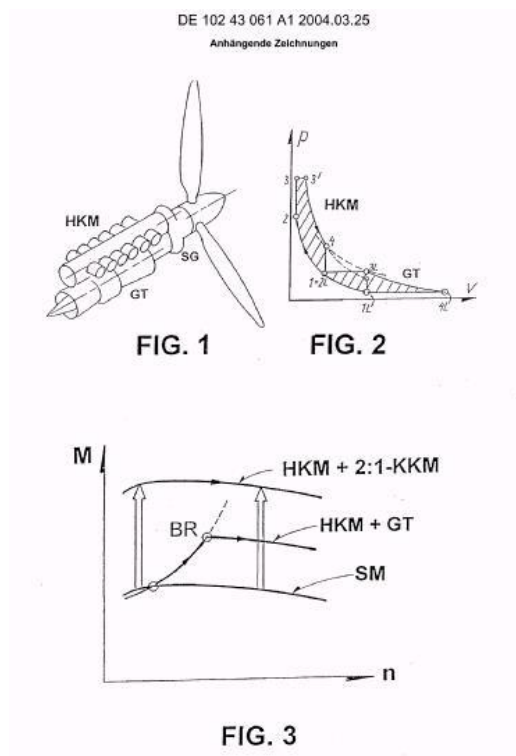
Engines for driving cycles; E.g.:



F02B 61/04**for driving propellers****Definition statement**

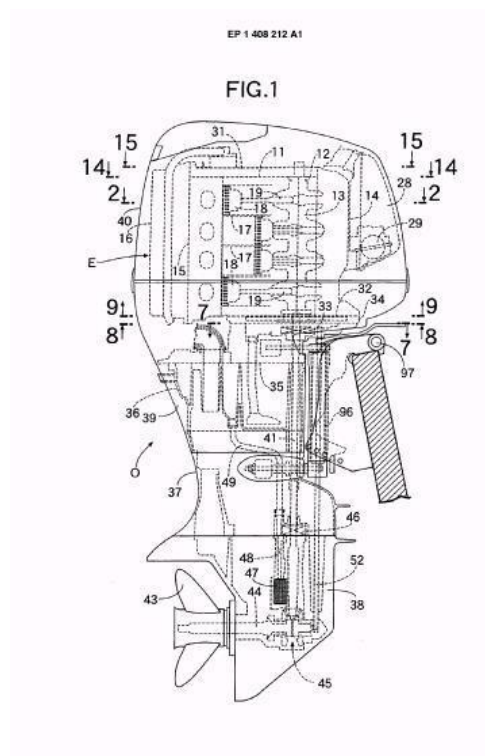
This place covers:

Engines for driving propellers; E.g.:



F02B 61/045**{for outboard marine engines}****Definition statement***This place covers:*

Outboard marine and engines, Inboard marine engines, Jetski engines.



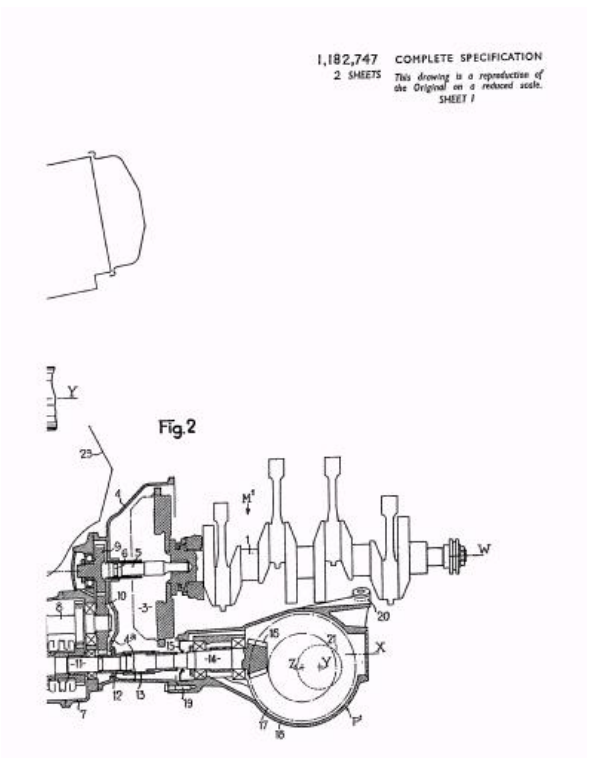
F02B 61/06

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:

Adaptations of rotary-piston or oscillating-piston engines	F02B 53/14
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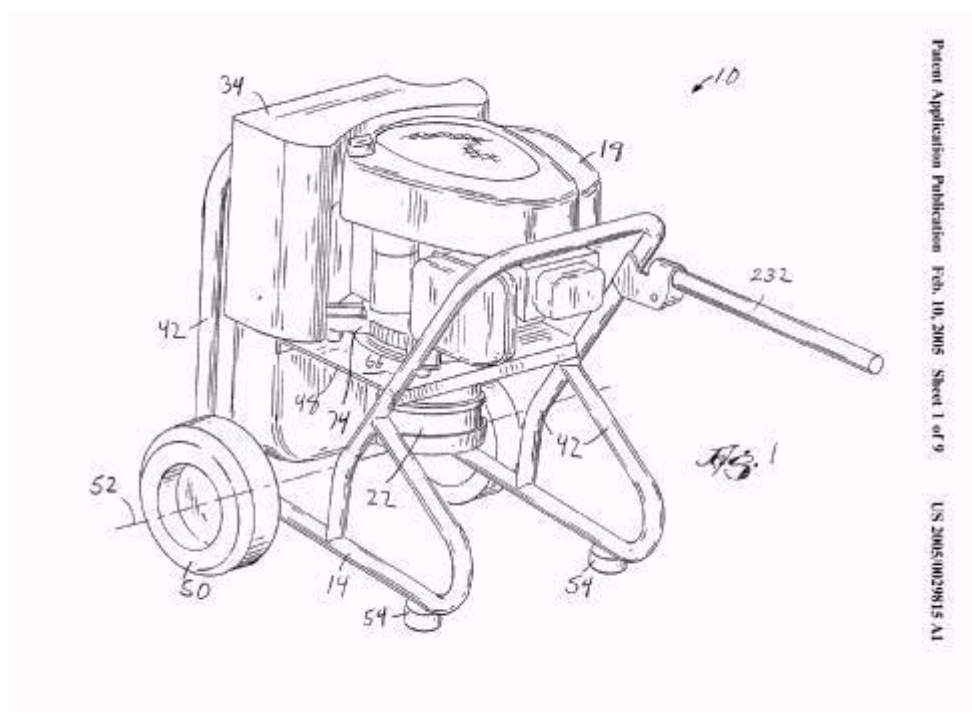
F02B 63/04

for electric generators

Definition statement

This place covers:

Adaptations of engines for electric generators; E.g.:



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:

Adaptations 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

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

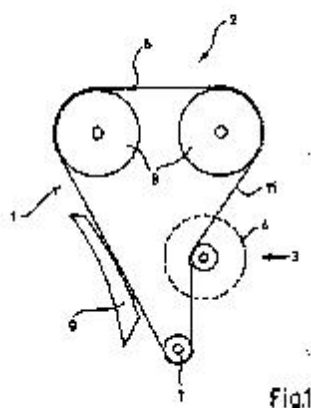
driven by means of chains, belts, or like endless members

Definition statement

This place covers:

Auxiliary devices driven by means of chains, belts, or like endless members

DE 10 2010 000 788 A1 2011.07.14
www1.pat.de Z441849.htm



F02B 67/08**of non-mechanically driven auxiliary apparatus****Definition statement**

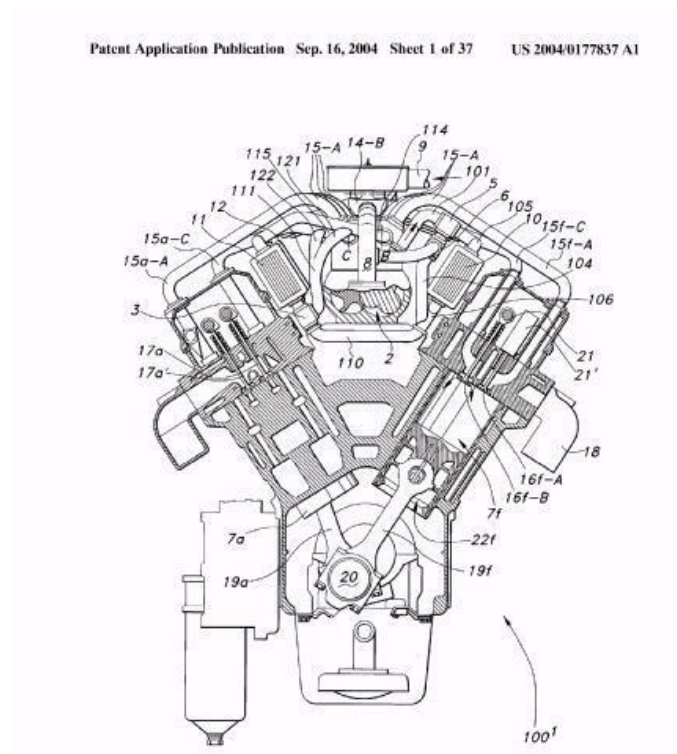
This place covers:

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.

Definition statement

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
--	----------------------------

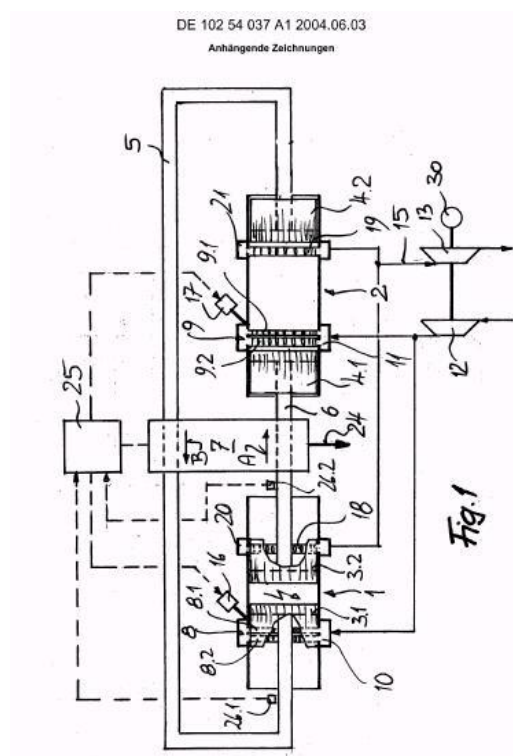
F02B 71/00

Free-piston engines; Engines without rotary main shaft

Definition statement

This place covers:

Free-piston engines; Engines without rotary main shaft. E.g.:



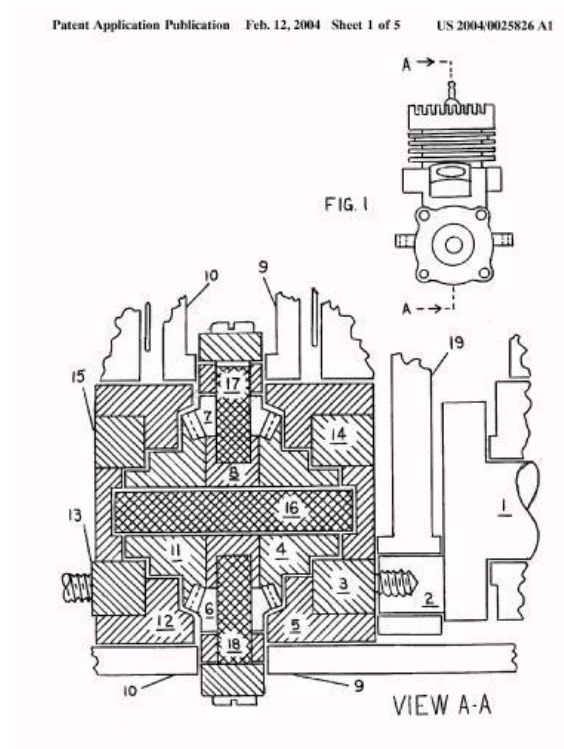
F02B 73/00

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

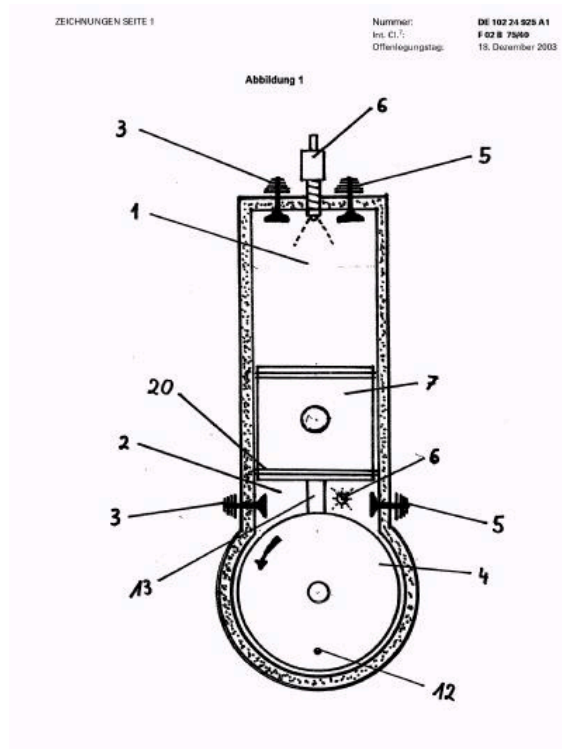
F02B 75/002

{Double acting engines}

Definition statement

This place covers:

Double acting engines



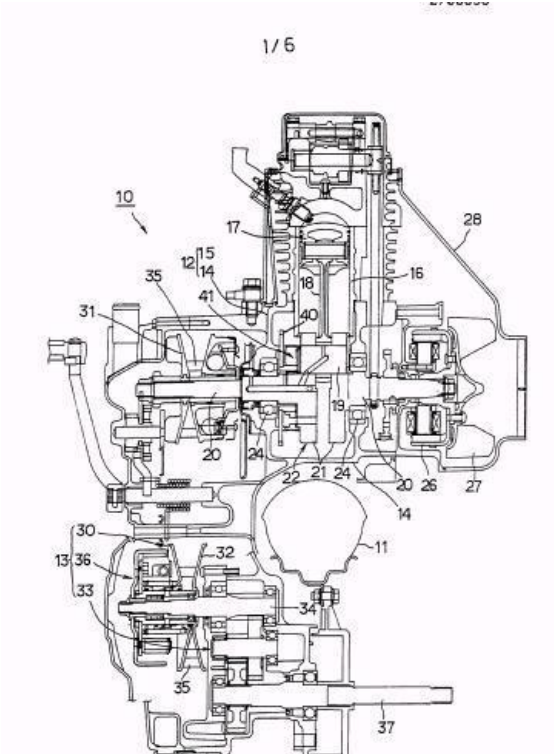
F02B 75/005

{having horizontal cylinders ([F02B 75/007](#) takes precedence)}

Definition statement

This place covers:

Engines having horizontal cylinders. E.g.:



References

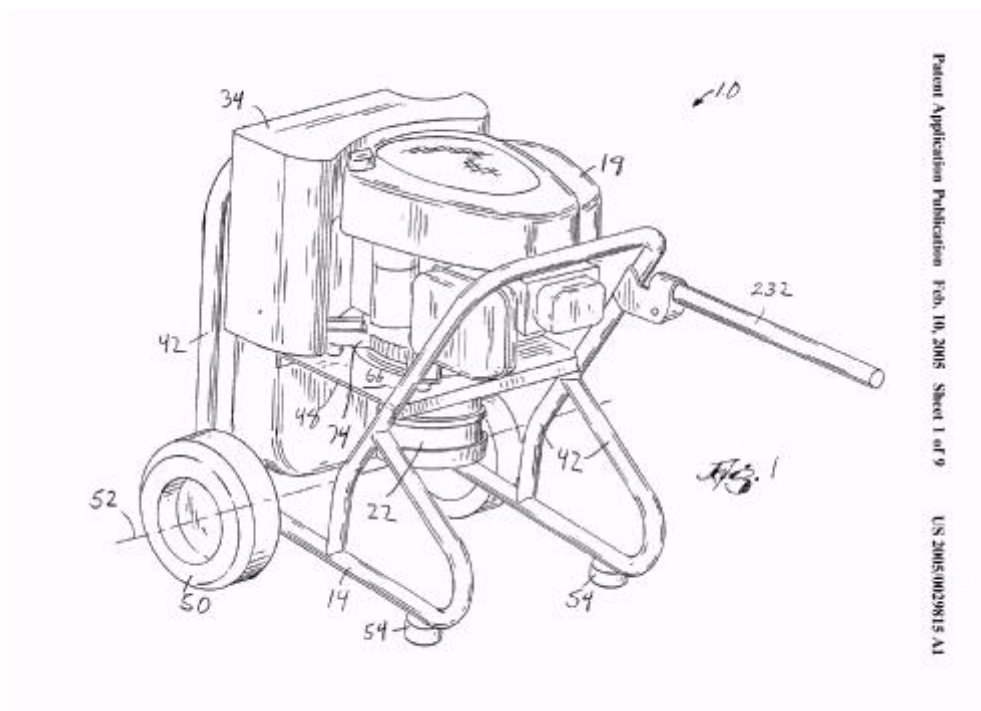
Limiting references

This place does not cover:

Engines having vertical crankshafts	F02B 75/007
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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:*

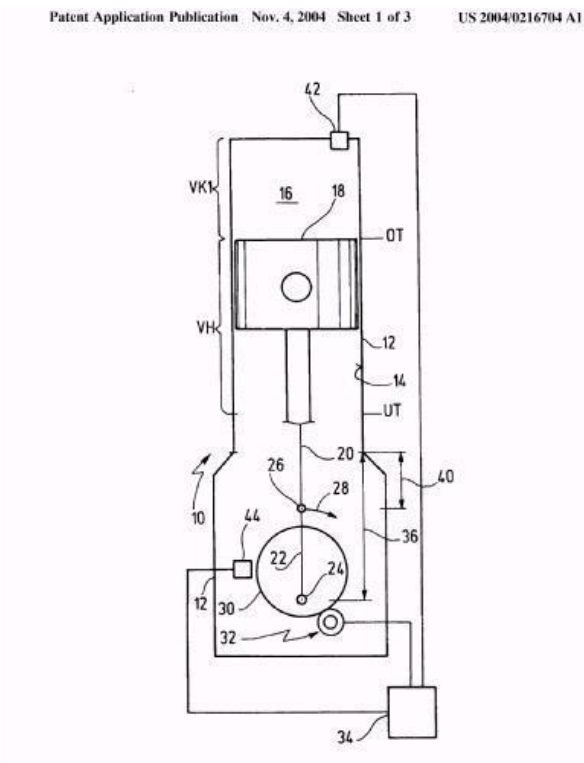
Engines characterised by their cycles, e.g. six-stroke.

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

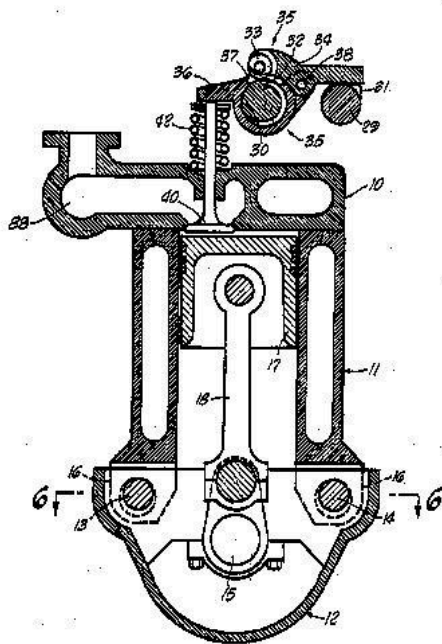
Attention is drawn to the following places, which may be of interest for search:

Valve operation	F01L
Controlling engines with variable distances between piston and cylinder head	F02D

F02B 75/041**{by means of cylinder or cylinderhead positioning}****Definition statement***This place covers:*

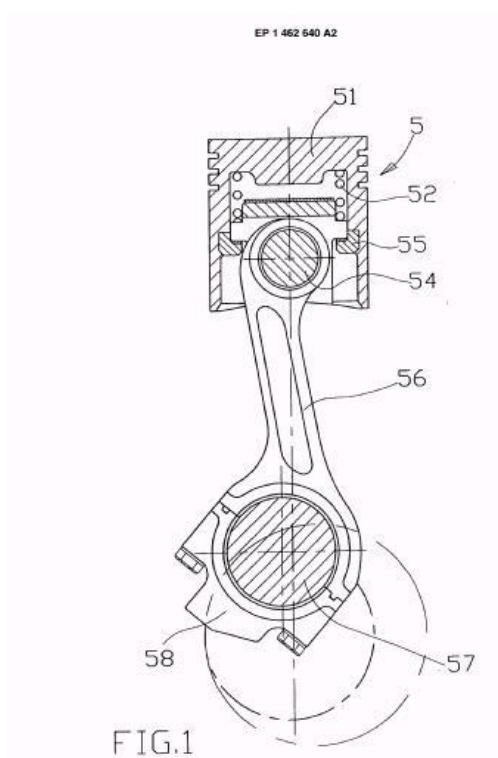
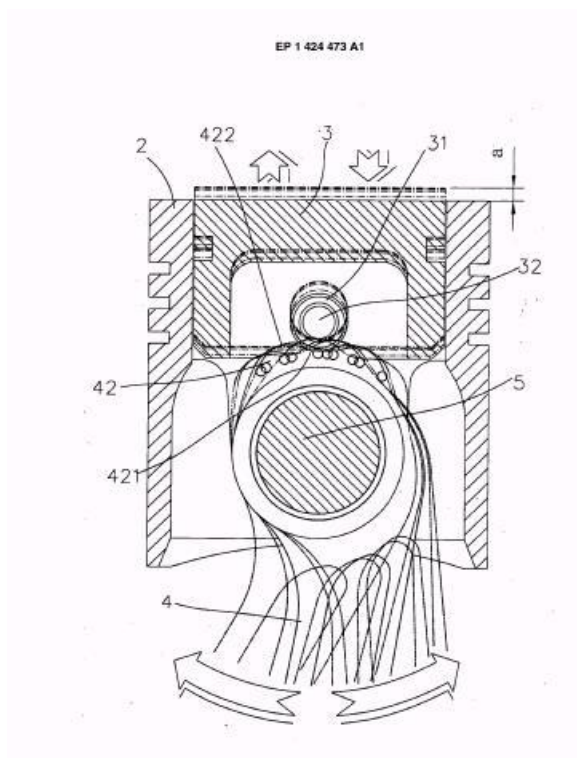
Engines characterised by means of cylinder or cylinder head positioning; E.g.:

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:*

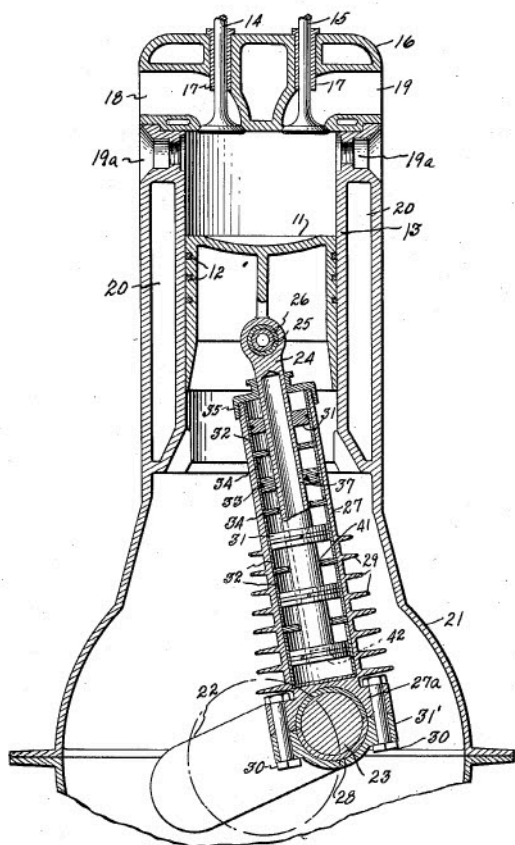
Engines characterised by means of an adjustable piston length; E.g.:



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.

Illustrative example of subject matter classified in this group:



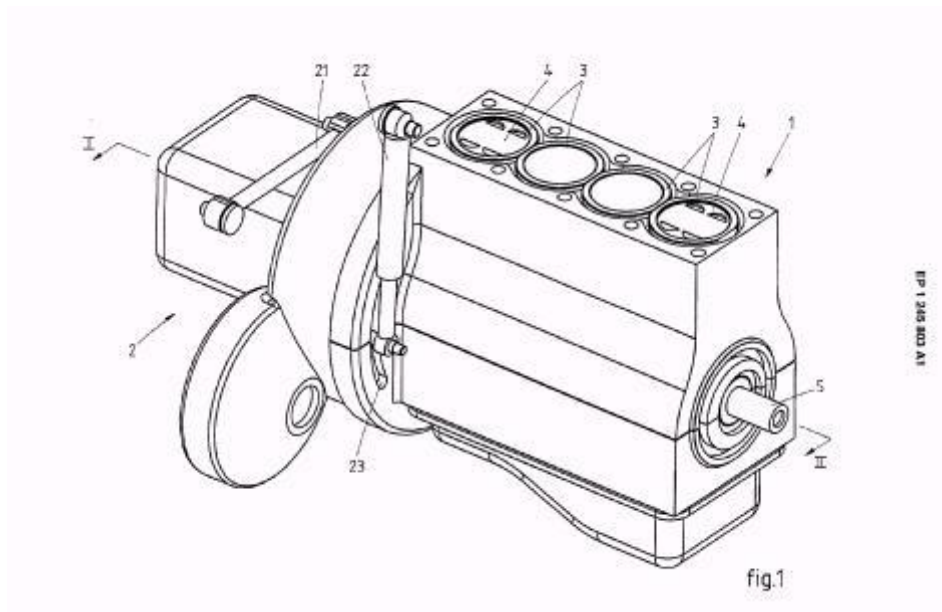
F02B 75/047

{by means of variable crankshaft position}

Definition statement

This place covers:

Engines characterised by means of variable crankshaft position; E.g.:



F02B 75/048

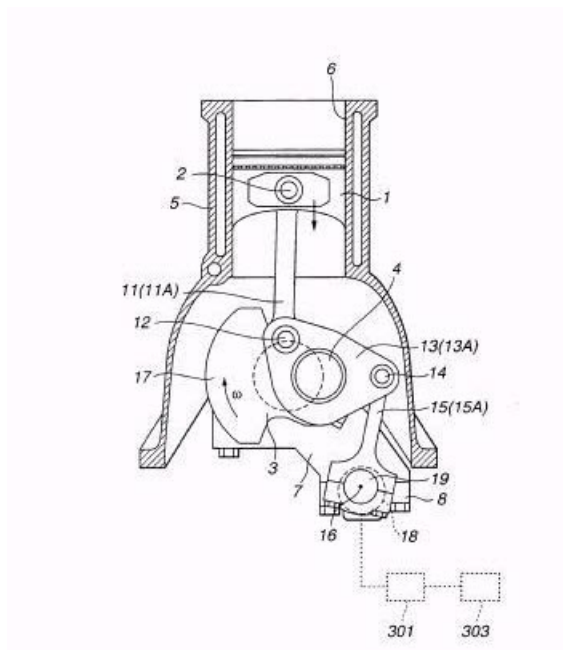
{by means of a variable crank stroke length}

Definition statement

This place covers:

Engines characterised by means of a variable crank stroke length.

Illustrative example of subject matter classified in this group:



F02B 75/06

Engines with means for equalising torque

References

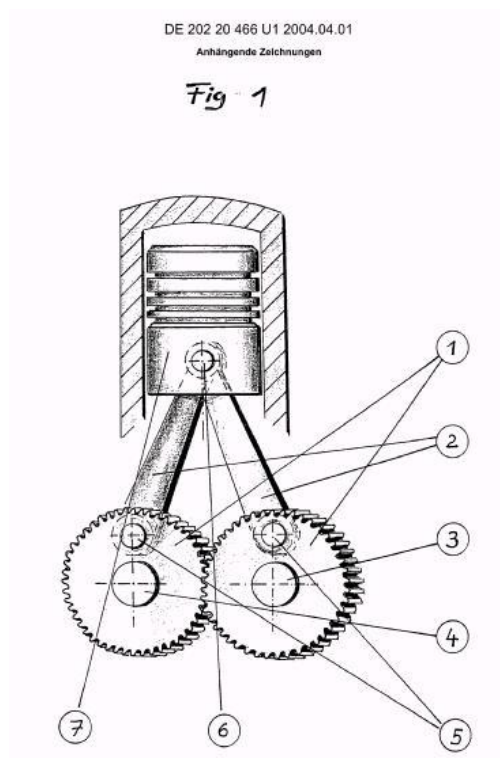
Informative references

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

Compensation of inertial forces, suppression of vibration in systems	F16F
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F02B 75/065**{with double connecting rods or crankshafts}****Definition statement***This place covers:*

Engines with double connecting rods or crankshafts; E.g.:



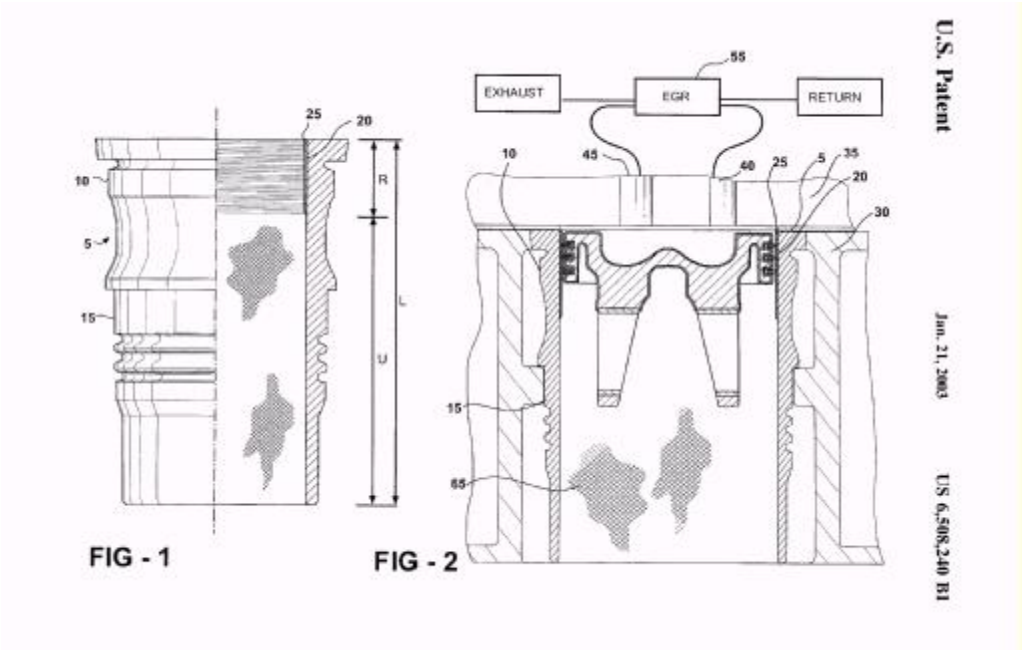
F02B 75/08

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
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F02B 75/10

Engines with means for rendering exhaust gases innocuous (apparatus per se [F01N 3/00](#))

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
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Informative references

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

Control of combustion engines	F02D
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F02B 75/1896

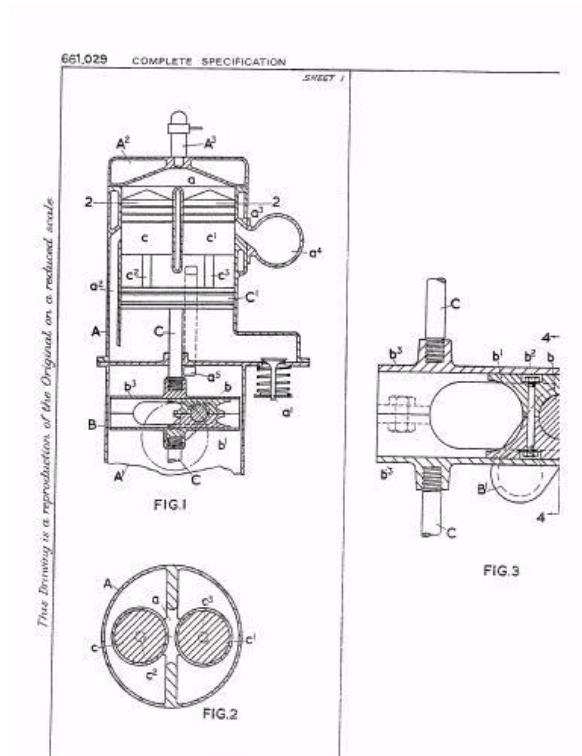
{with two or more pistons connected to one crank and having a common combustion space}

Definition statement

This place covers:

Engines with two or more pistons connected to one crank and having a common combustion space;

E.g.:



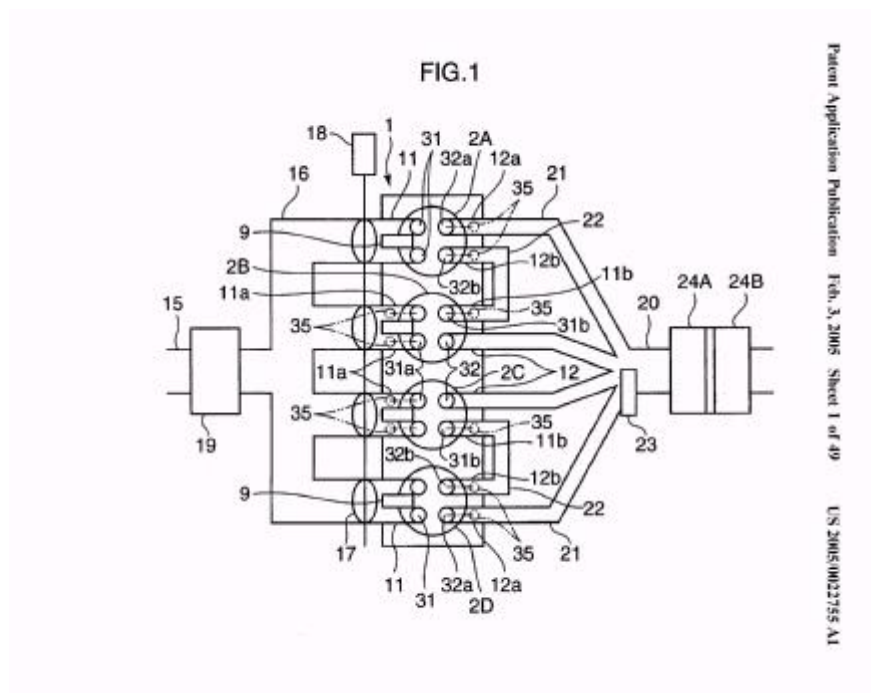
F02B 75/20

with cylinders all in one line

Definition statement

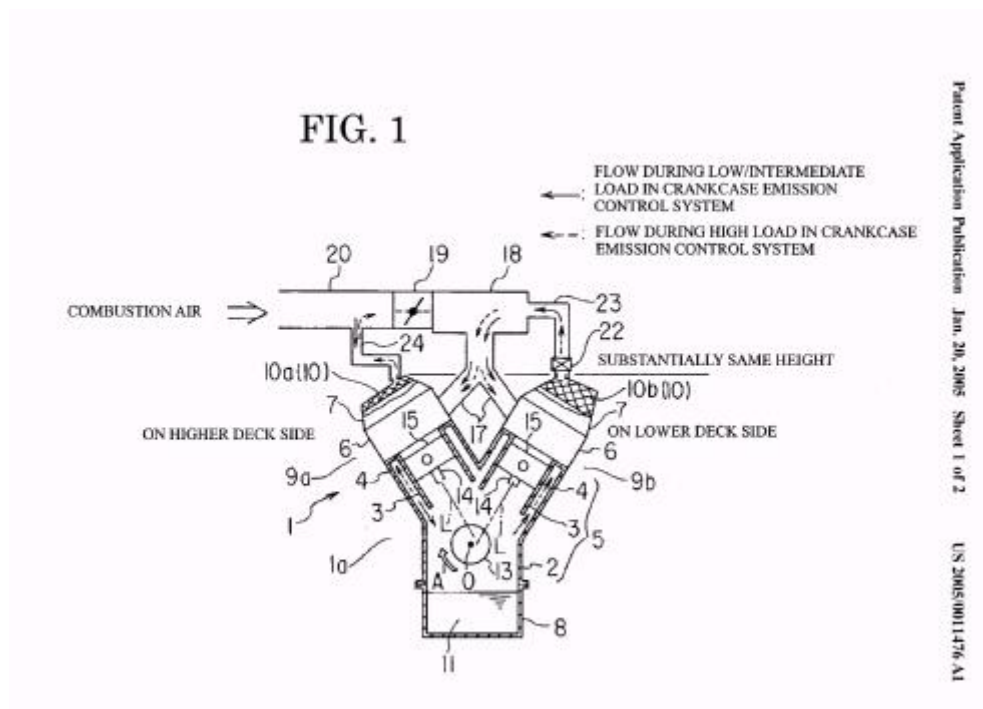
This place covers:

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



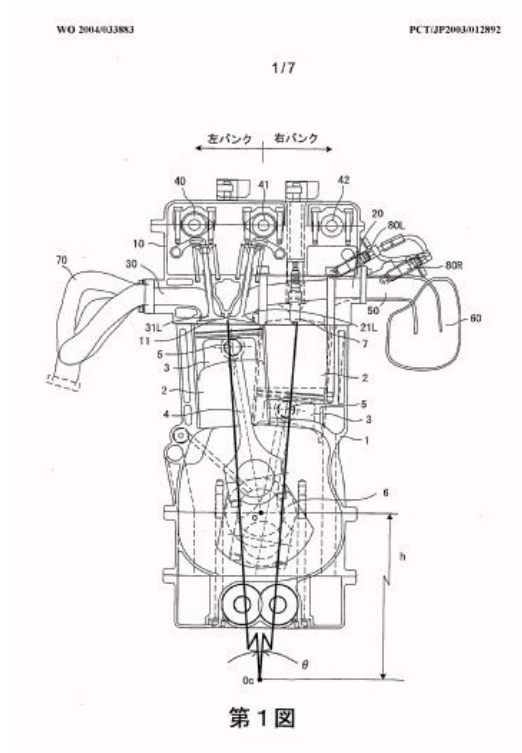
F02B 75/221

{with cylinder banks in narrow V-arrangement, having a single cylinder head}

Definition statement

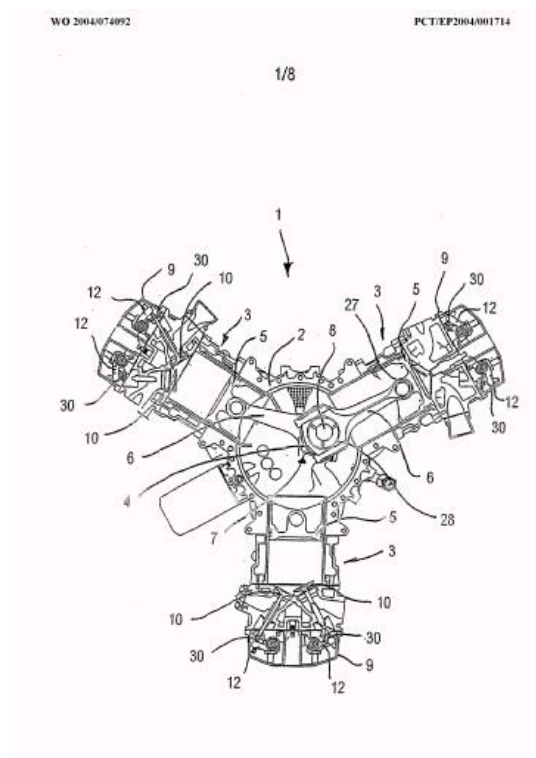
This place covers:

Engines with cylinder banks in narrow V-arrangement, having a single cylinder head.



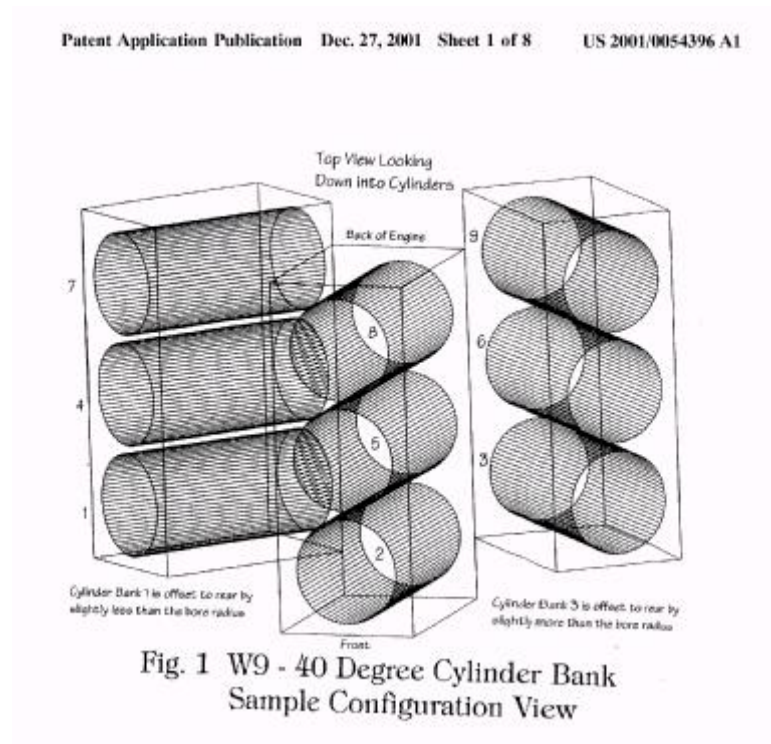
F02B 75/222**{with cylinders in star arrangement}****Definition statement***This place covers:*

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



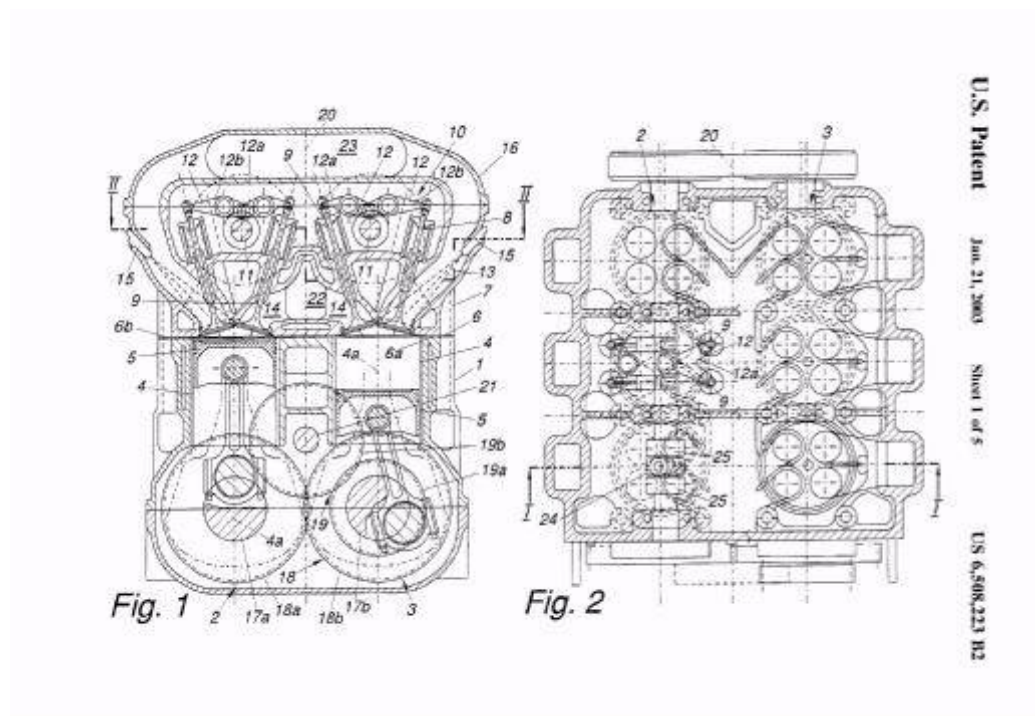
F02B 75/225

{having two or more crankshafts}

Definition statement

This place covers:

Engines having two or more crankshafts



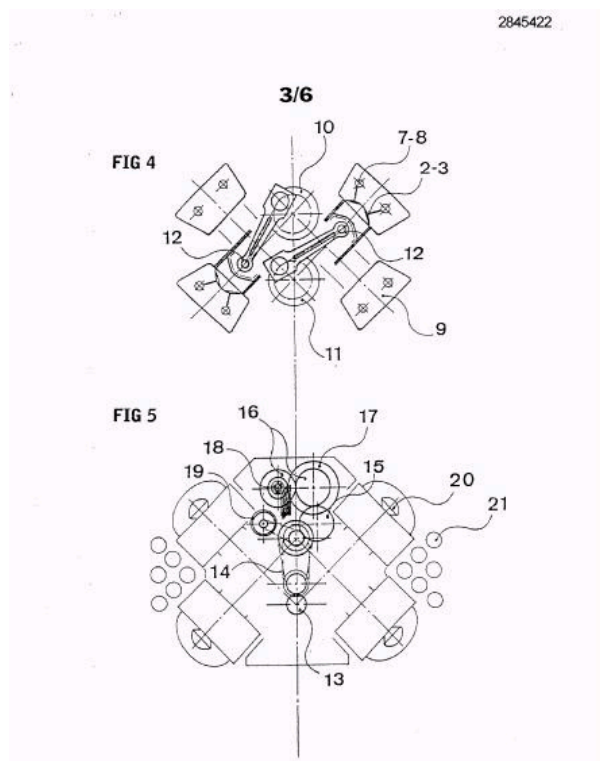
F02B 75/227

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

Definition statement

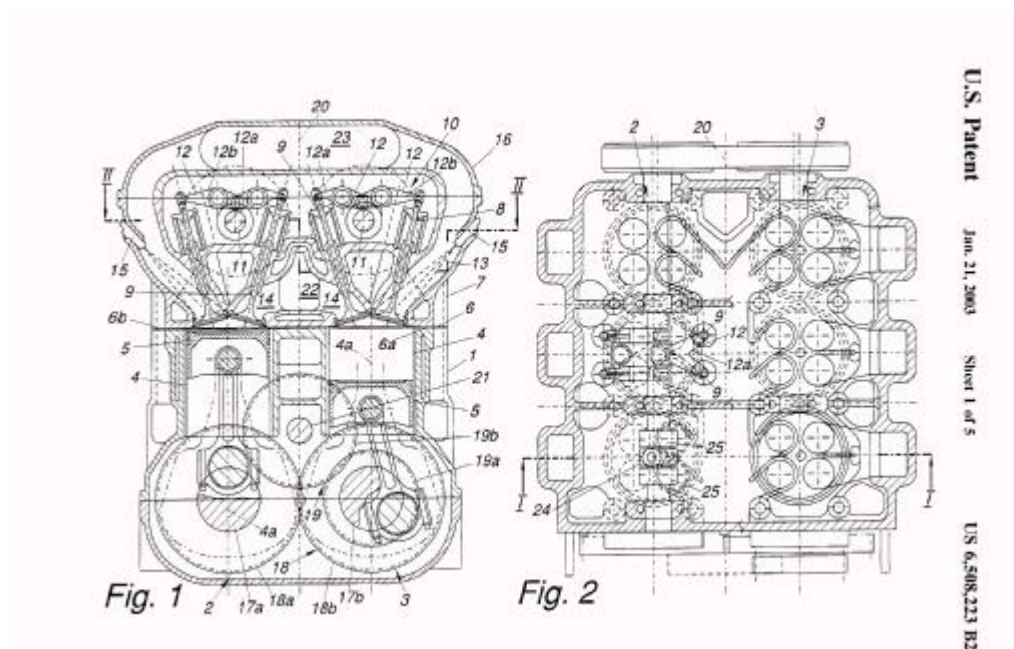
This place covers:

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



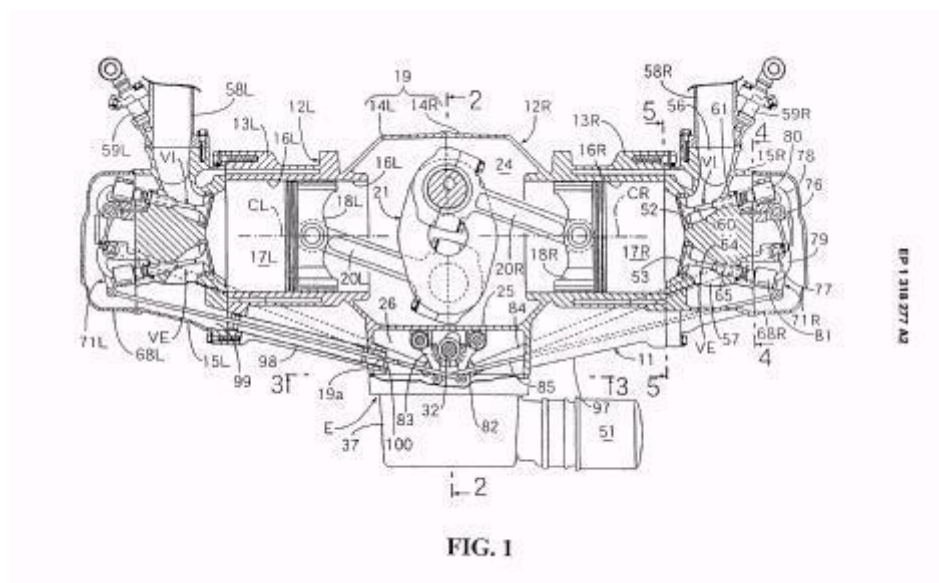
F02B 75/243

{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



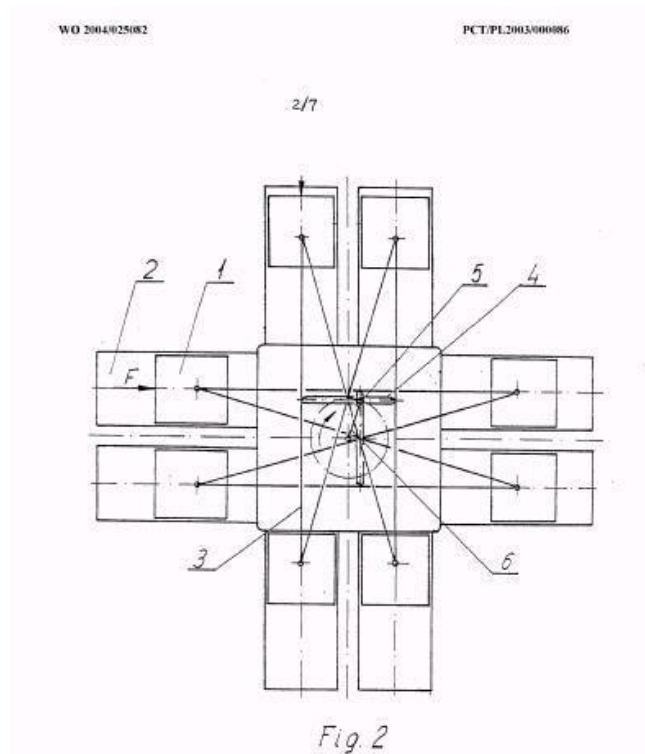
F02B 75/246

{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



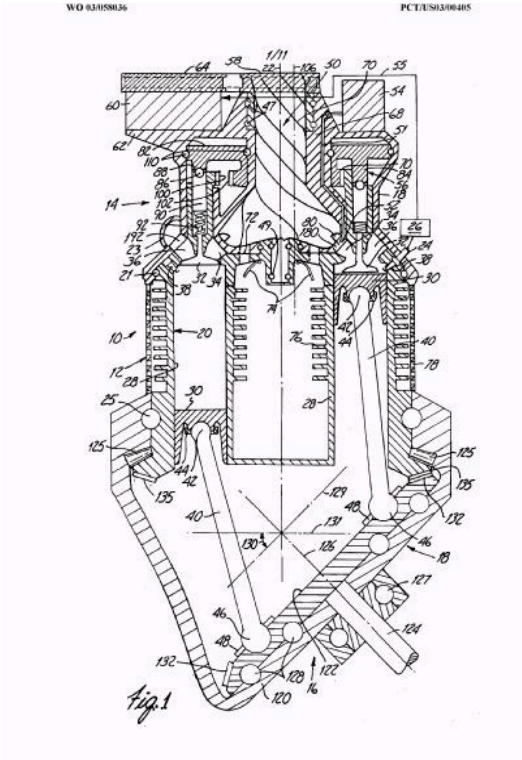
F02B 75/26

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, or parallel or inclined to, main shaft axis	F01B 3/00
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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

DE 103 15 833 A1 2004.10.21

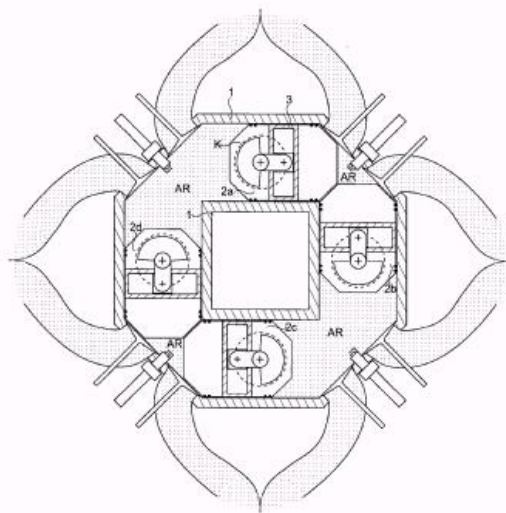


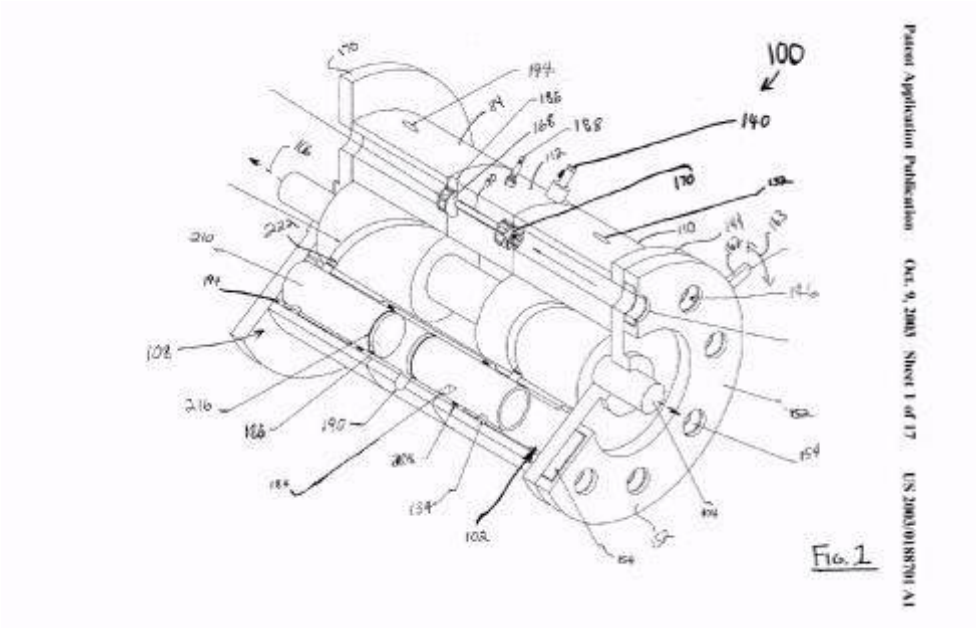
Fig. 3

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
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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
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F02B 75/282

{the pistons having equal strokes}

Definition statement

This place covers:

Engines with pistons having equal strokes

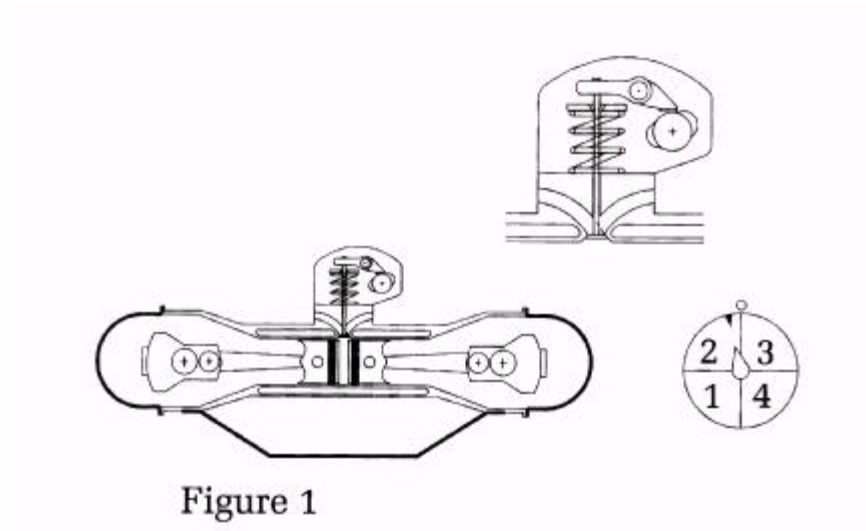
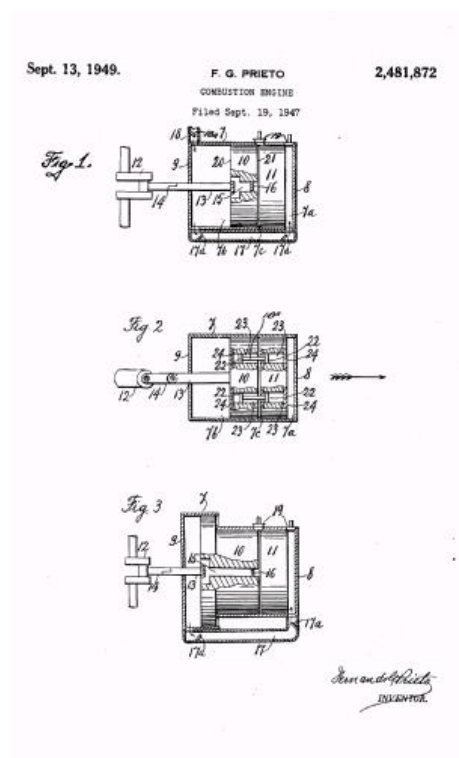


Figure 1

F02B 75/285**{comprising a free auxiliary piston}****Definition statement***This place covers:*

Engines comprising a free auxiliary piston



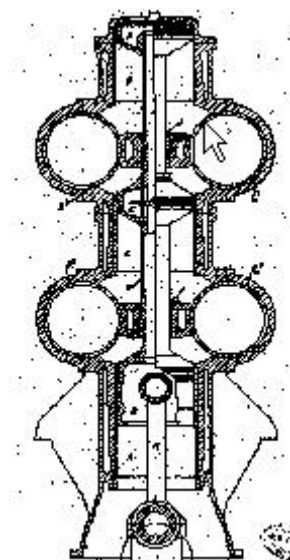
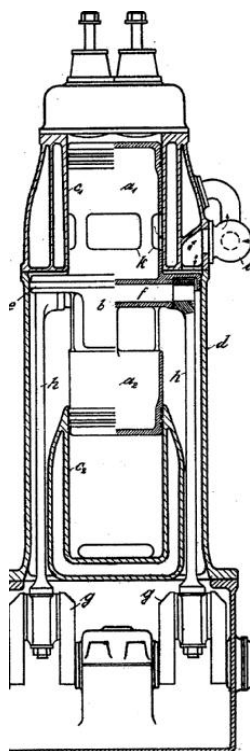
F02B 75/287

{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



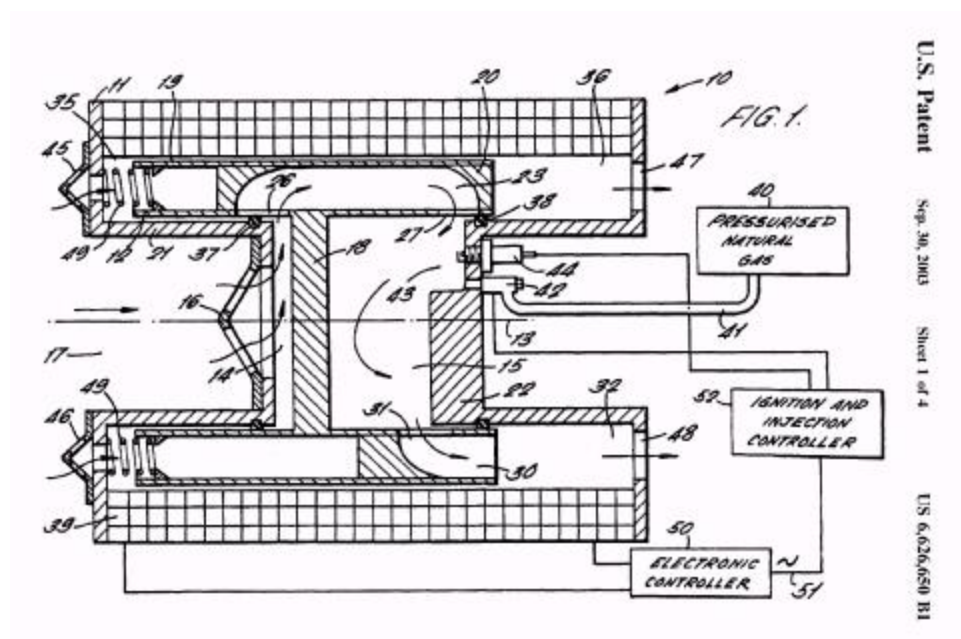
F02B 75/30

with one working piston sliding inside another

Definition statement

This place covers:

Engines with one working piston sliding inside another

**F02B 75/32**

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

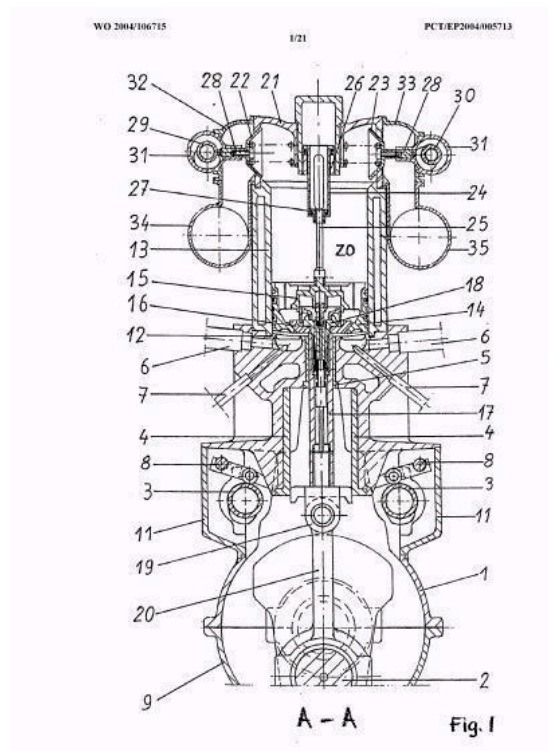
Definition statement

This place covers:

This subgroup contains all mechanisms between pistons and main shafts not otherwise described in more pertinent classes.

Definition statement

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
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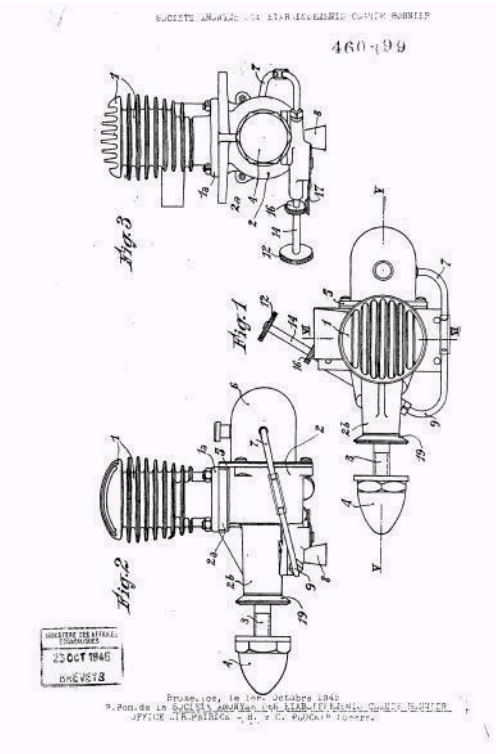
F02B 75/34

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 "amylnitrate" are often used.

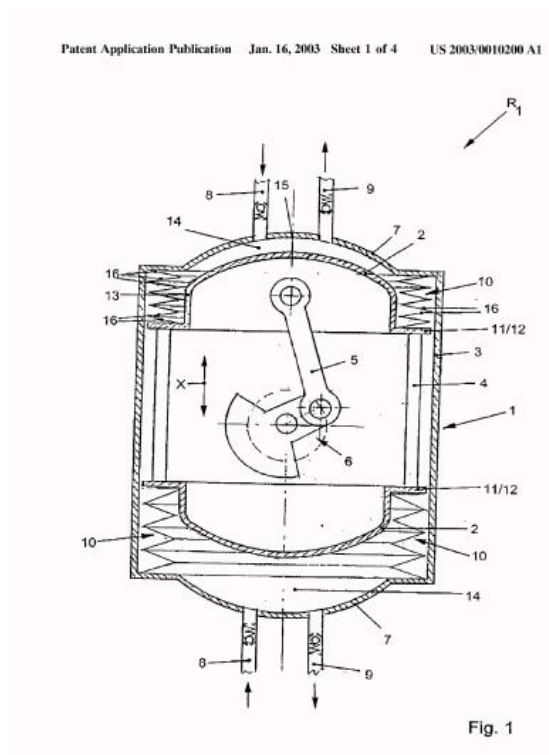
F02B 75/36

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



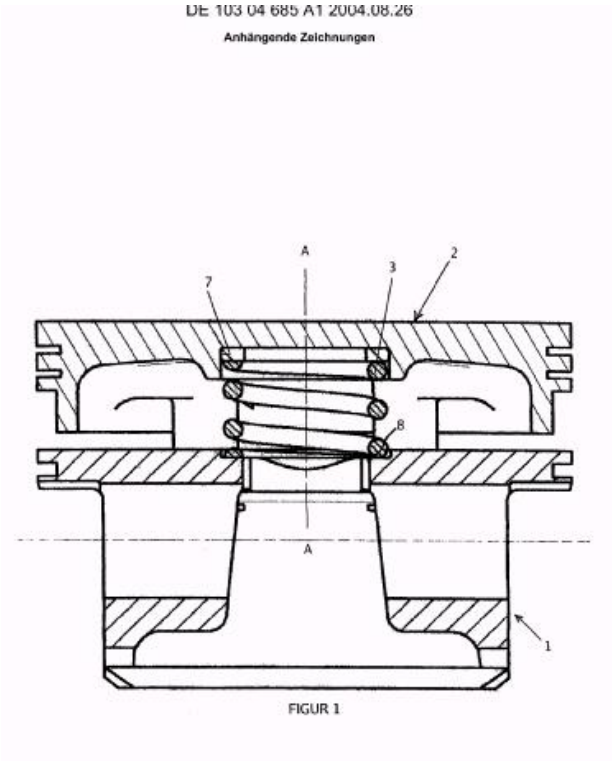
F02B 75/38

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

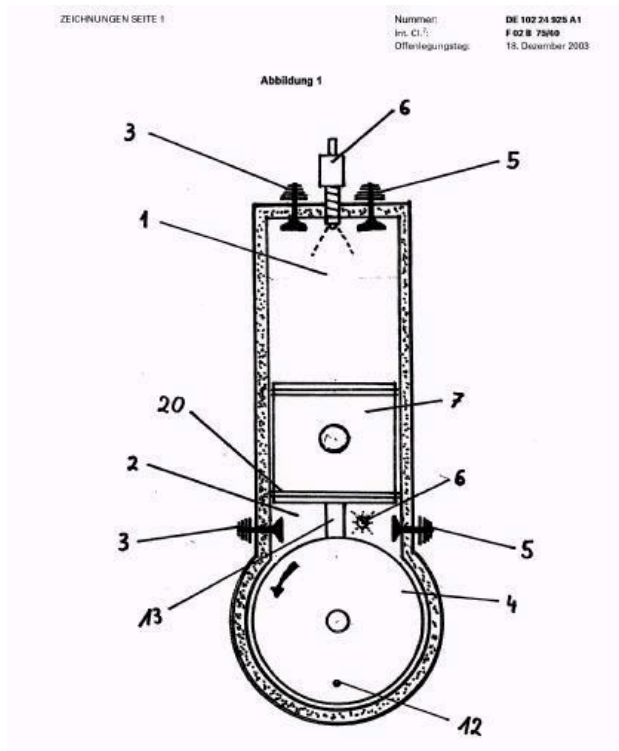
Other reciprocating-piston engines

Definition statement

This place covers:

Other reciprocating-piston engines

E.g.:



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 [F02F 3/10](#); of cylinders and cylinder heads [F02F 1/00](#))

References

Limiting references

This place does not cover:

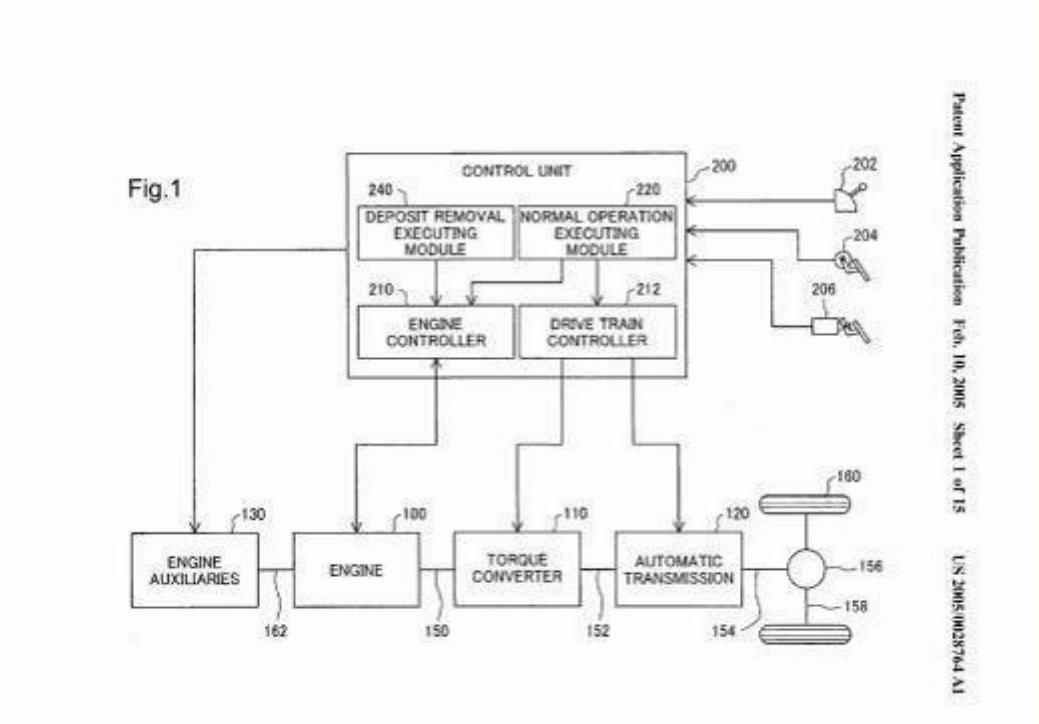
Surface coverings of cylinders and cylinder heads	F02F 1/00
Surface coverings of pistons	F02F 3/10

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
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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

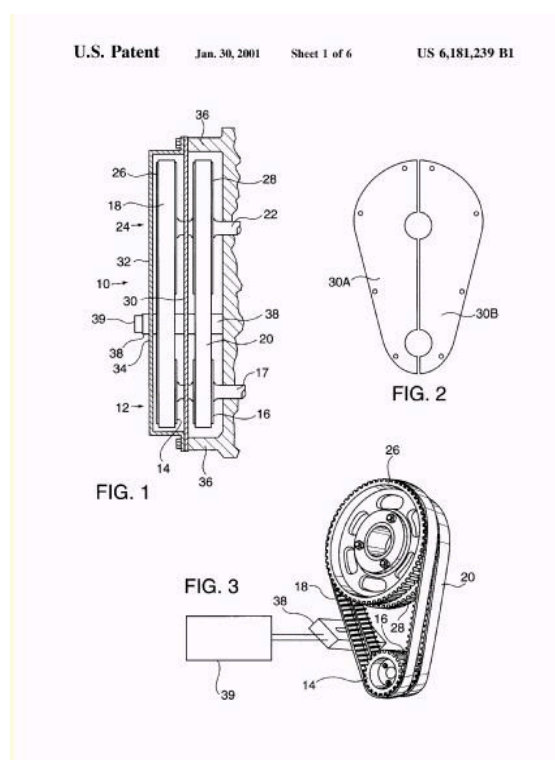
F02B 77/081

{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

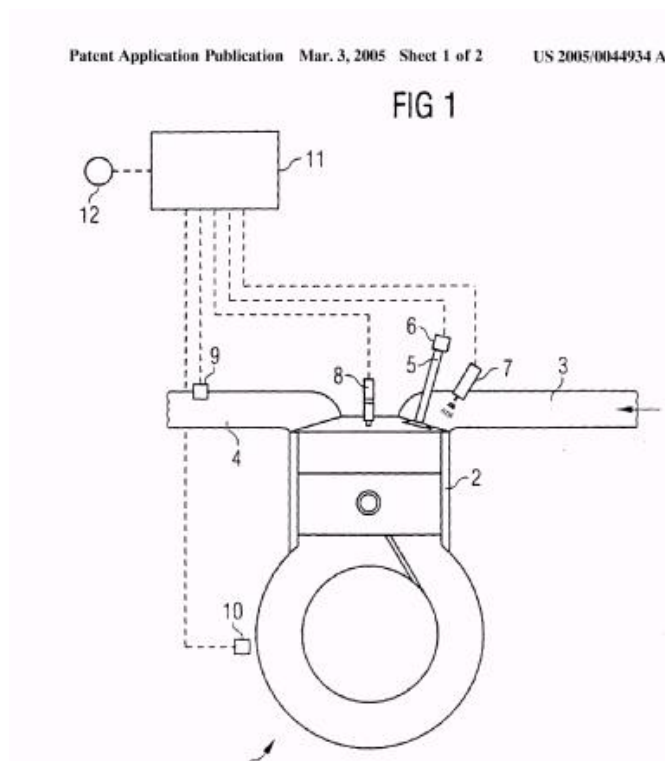
Informative references

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
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F02B 77/082**{relating to valves}****Definition statement***This place covers:*

Safety, indicating or supervising devices relating to valves



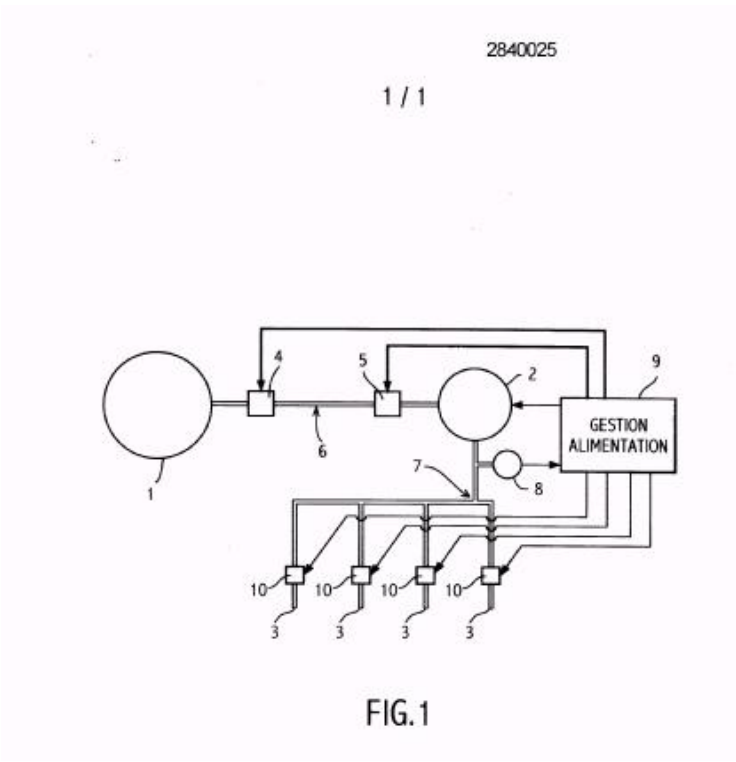
F02B 77/083

{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:

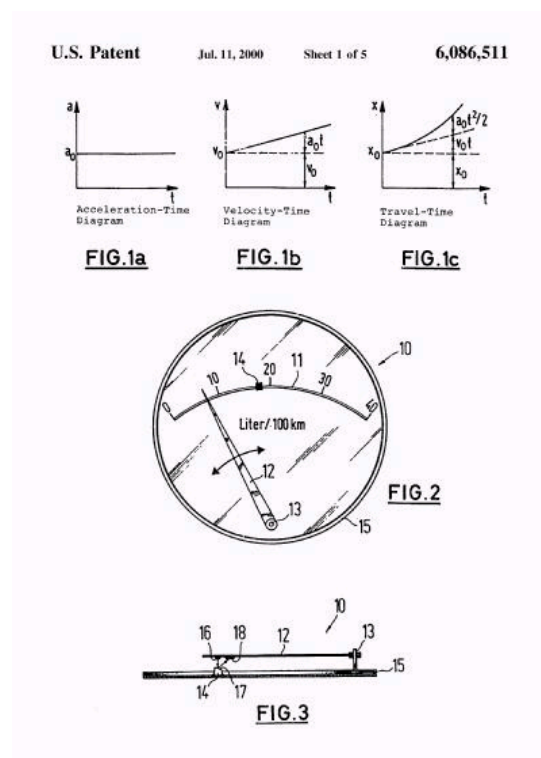
Indicating and safety devices concerning lubricant level	F01M 11/10
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F02B 77/084

{indicating economy}

Definition statement*This place covers:*

Safety, indicating or supervising devices indicating economy

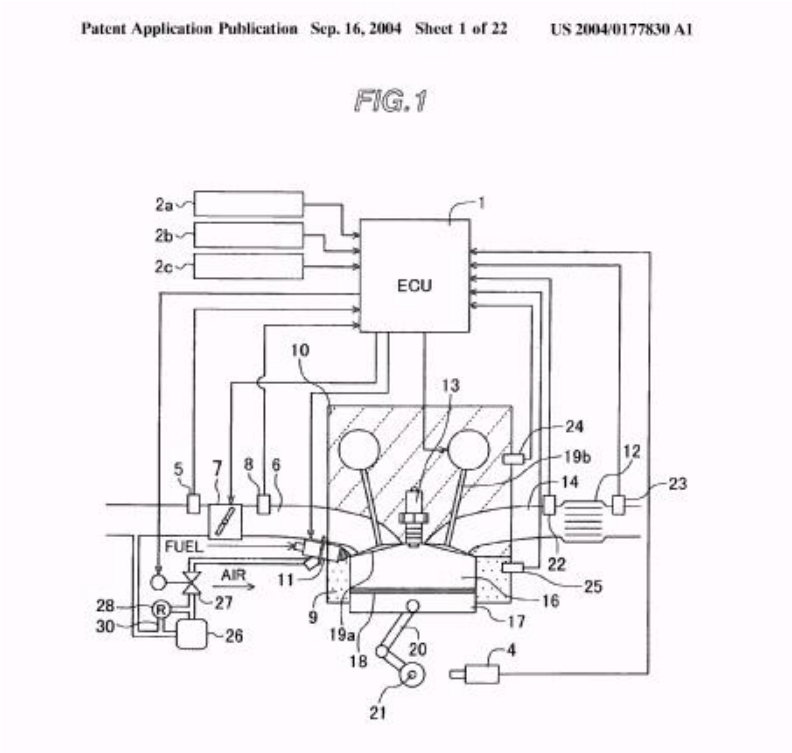


F02B 77/085

{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
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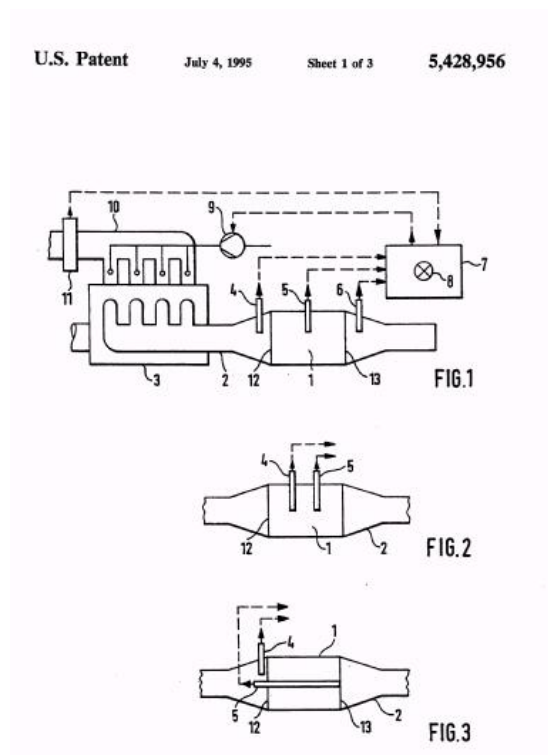
F02B 77/086

{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
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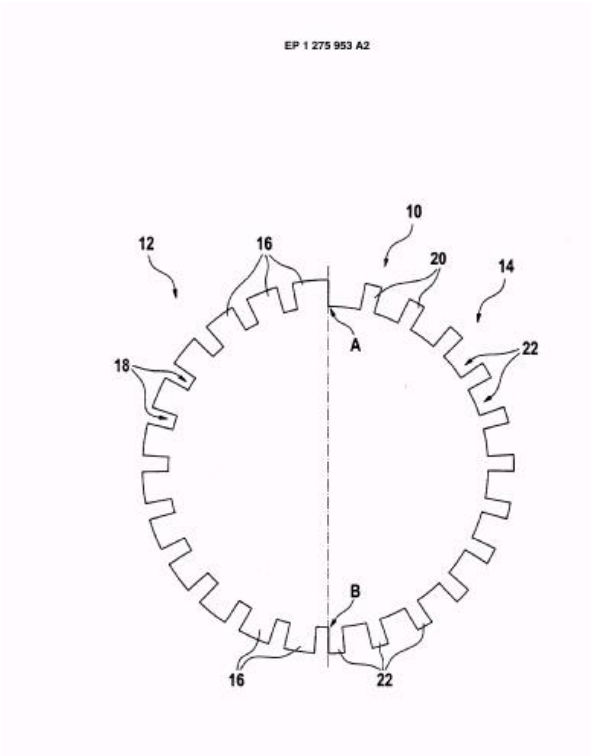
F02B 77/087

{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
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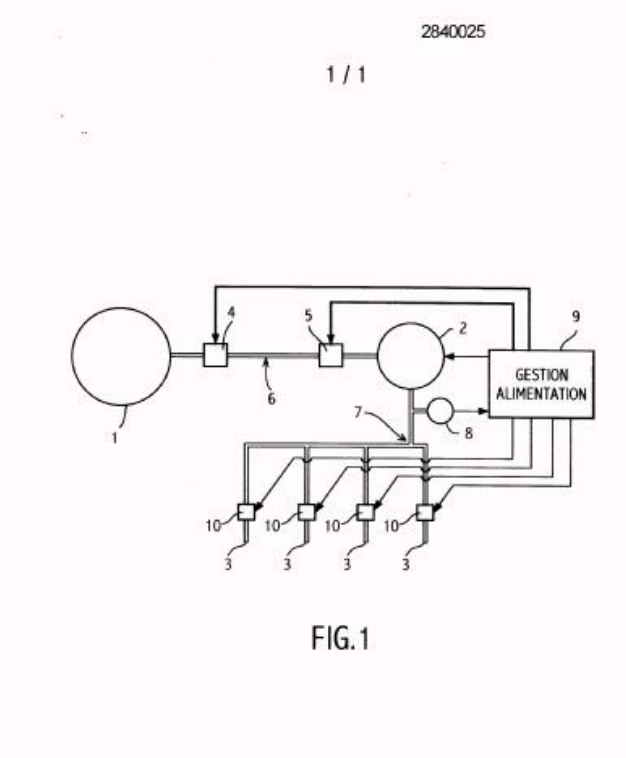
F02B 77/088

{relating to tightness}

Definition statement

This place covers:

Safety, indicating or supervising devices relating to tightness



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
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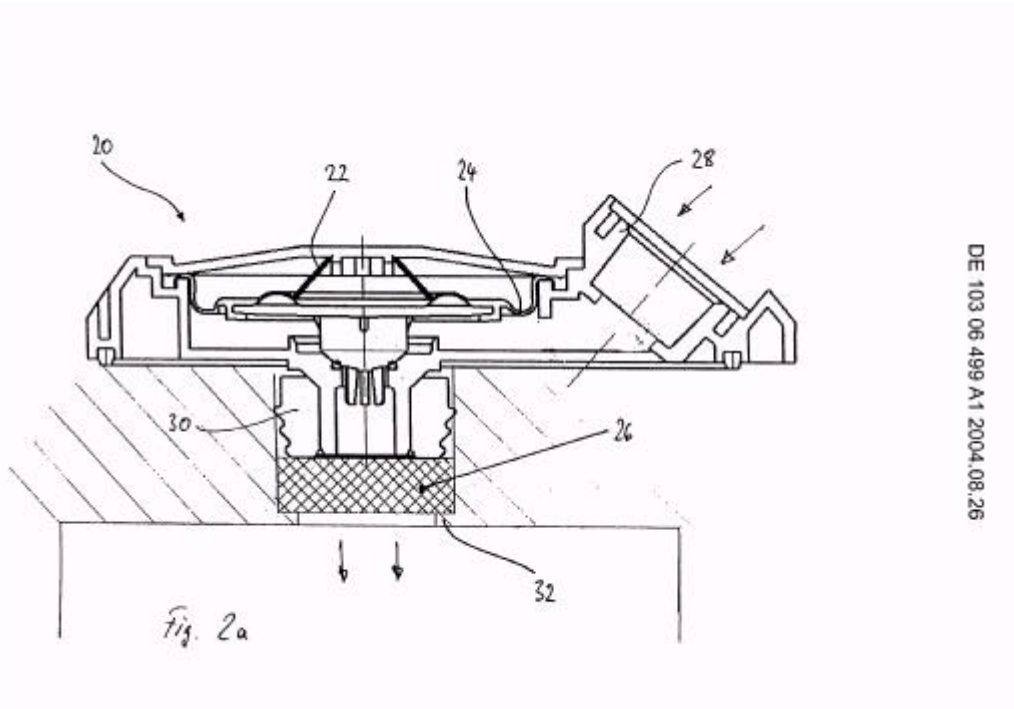
F02B 77/10

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
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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
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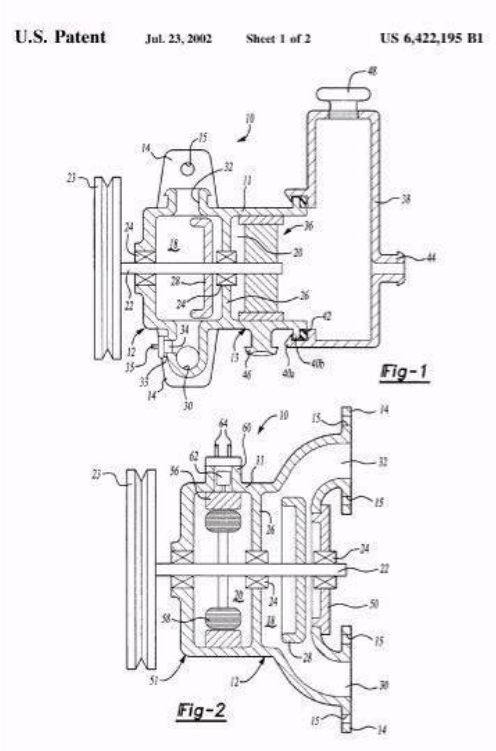
F02B 77/14

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.



F02B 79/00

Running-in of internal-combustion engines (lubrication thereof [F01M 7/00](#))

Definition statement

This place covers:

Running-in of internal-combustion engines.

References

Limiting references

This place does not cover:

Lubrication of internal combustion engines	F01M 7/00
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