

## ENGINES OR PUMPS

### Notes

#### Guide to the use of this subsection (classes F 01 to F 04)

The following notes are meant to assist in the use of this part of the classification scheme.

- (1) In this subsection, subclasses or groups designating “engines” or “pumps” cover methods of operating the same, unless otherwise specifically provided for.
- (2) In this subsection, the following terms or expressions are used with the meanings indicated:
- “engine” means 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 meter;
  - “pump” means a device for continuously raising, forcing, compressing, or exhausting fluid by mechanical or other means. Thus, this term includes fans or blowers;
  - “machine” means 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” means 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” means 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” means a positive-displacement machine in which a fluid-engaging work-transmitting member oscillates. This definition applies also to engines and pumps;
  - “rotary-piston machine” means 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” means the work-transmitting member of a rotary-piston machine and may be of any suitable form, e.g., like a toothed gear;
  - “cooperating members” means 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” means 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” means a piston of which the length of stroke is not defined by any member driven thereby;
  - “cylinders” means positive-displacement working chambers in general. Thus, this term is not restricted to cylinders of circular cross-section;
  - “main shaft” means the shaft which converts reciprocating piston motion into rotary motion or vice versa;
  - “plant” means 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” means the driven fluid in a pump and the driving fluid in an engine. The working fluid may be in a gaseous state, i.e., compressible, or liquid. In the former case coexistence of two states is possible;
  - “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”.
- (3) In this subsection:
- cyclically operating valves, lubricating, gas-flow silencers or exhaust apparatus, or cooling are classified in subclasses **F 01 L, M, N, P** irrespective of their stated application, unless their classifying features are peculiar to their application, in which case they are classified only in the relevant subclass of classes F 01 to F 04;
  - lubricating, gas-flow silencers or exhaust apparatus, or cooling of machines or engines are classified in subclasses **F 01 M, N, P** except for those peculiar to steam engines which are classified in subclass **B**.
- (4) For use of this subsection with a good understanding, it is essential to remember, so far as subclasses **F 01 B, C, D, F 03 B,** and **F 04 B, C, D,** which form its skeleton, are concerned:
- the principle which resides in their elaboration,
  - the classifying characteristics which they call for, and
  - their complementarity.
- (i) Principle  
This concerns essentially the subclasses listed above. Other subclasses, notably those of class F 02, which cover better-defined matter, are not considered here.  
Each subclass covers fundamentally a genus of apparatus (engine or pump) and by extension covers equally “machines” of the same kind. Two different subjects, one having a more general character than the other, are thus covered by the same subclass.

Subclasses F 01 B, F 03 B, F 04 B, beyond the two subjects which they cover, have further a character of generality in relation to other subclasses concerning the different species of apparatus in the genus concerned.

This generality applies as well for the two subjects dealt with, without these always being in relation to the same subclasses.

Thus, subclass F 03 B, in its part dealing with “machines”, should be considered as being the general class relating to subclasses F 04 B, C, and in its part dealing with “engines” as being general in relation to subclass F 03 C.

(ii) Characteristics

The principal classifying characteristic of the subclass is that of genera of apparatus, of which there are three possible:

Machines; engines; pumps.

As stated above, “machines” are always associated with one of the other two genera. These main genera are subdivided according to the general principles of operation of the apparatus:

Positive displacement; non-positive displacement.

The positive displacement apparatus are further subdivided according to the ways of putting into effect the principle of operation, that is, to the kind of apparatus:

Simple reciprocating piston; rotary or oscillating piston; other kind.

Another classifying characteristic is that of the working fluid, in respect of which three kinds of apparatus are possible, namely:

Liquid and elastic fluid; elastic fluid; liquid.

(iii) Complementarity

This resides in association of pairs of the subclasses listed above, according to the characteristics under consideration in respect of kind of apparatus or working fluid.

The subclasses concerned with the various principles, characteristics and complementarity are shown in the following table:

Kind of displacement			Working fluid			Relations of generality in respect of kind of displacement	
positive		non-positive	liquid and elastic fluid	elastic fluid	liquid		
reciprocating piston	rotary or oscillating piston						other
<b>MACHINES</b>							
x		x		x	x		F 01 B
	x			x	x		F 01 C
			x	x			F 01 D
			x			x	F 03 B
x		x				x	F 04 B
	x					x	F 04 C
<b>ENGINES</b>							
x		x		x	x		F 01 B
	x			x	x		F 01 C
			x	x			F 01 D
			x			x	F 03 B
x		x				x	F 03 C
<b>PUMPS</b>							
x		x		x	x	x	F 04 B
	x			x	x	x	F 04 C
			x	x	x	x	F 04 D

It is seen from this table that:

- For the same kind of apparatus in a given genus, the characteristic of “working fluid” associates:

F 01 B and F 04 B	}	Machines
F 01 C and F 04 C		
F 01 D and F 03 B		
F 01 B and F 03 C	}	Engines
F 01 C and F 03 C		
F 01 D and F 03 B		

- For the same kind of working fluid, the “apparatus” characteristic relates subclasses in the same way as considerations of relative generality.

F 01 B

F 01 **MACHINES OR ENGINES IN GENERAL** (combustion engines F 02; machines for liquids F 03, F 04); **ENGINE PLANTS IN GENERAL; STEAM ENGINES**

F 01 B **MACHINES OR ENGINES, IN GENERAL OR OF POSITIVE-DISPLACEMENT TYPE, e.g. STEAM ENGINES** (of rotary-piston or oscillating-piston type F 01 C; of non-positive-displacement type F 01 D; internal-combustion aspects of reciprocating-piston engines F 02 B 57/00, 59/00; crankshafts, crossheads, connecting-rods F 16 C; flywheels F 16 F; gearings for interconverting rotary motion and reciprocating motion in general F 16 H; pistons, piston-rods, cylinders, for engines in general F 16 J)

**Notes**

- (1) This subclass covers, with the exception of the matter provided for in subclasses F 01 C to P:
  - engines for elastic fluids, e.g. steam engines;
  - engines for liquids and elastic fluids;
  - machines for elastic fluids;
  - machines for liquids and elastic fluids.
- (2) Attention is drawn to the Notes preceding class F 01, especially as regards the definitions of “steam” and “special vapour”.

**Subclass Index**

MACHINES OR ENGINES	rotary or other movement of cylinders .....	13/00, 15/00
With reciprocating pistons characterised by	uniflow principle .....	17/00
number or relative disposition of cylinders .....	With positive displacement of flexible-wall type .....	19/00
disposition of cylinder axes relative to main shaft.....	COMBINATIONS OR ADAPTATIONS OF MACHINES OR ENGINES .....	21/00, 23/00
pistons reciprocating in same or coaxial cylinders; piston-main-shaft connections other than covered above .....	REGULATING, CONTROLLING, SAFETY MEANS; STARTING.....	25/00; 27/00
no rotary main shaft .....	OTHER CHARACTERISTICS; DETAILS, ACCESSORIES .....	29/00; 31/00

<b>1/00 Reciprocating-piston machines or engines characterised by number or relative disposition of cylinders or by being built-up from separate cylinder-crankcase elements (3/00, 5/00 take precedence) [2]</b>	3/08 . . . the helices being arranged on the pistons
1/01 . with one single cylinder [2]	3/10 . Control of working-fluid admission or discharge peculiar thereto (suitable for more general application F 01 L)
1/02 . with cylinders all in one line	<b>5/00 Reciprocating-piston machines or engines with cylinder axes arranged substantially tangentially to a circle centred on main shaft axis</b>
1/04 . with cylinders in V-arrangement	<b>7/00 Machines or engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders (in opposite arrangement relative to main shaft 1/08)</b>
1/06 . with cylinders in star or fan arrangement	7/02 . with oppositely reciprocating pistons
1/08 . with cylinders arranged oppositely relative to main shaft and of “flat” type	7/04 . . acting on same main shaft
1/10 . with more than one main shaft, e.g. coupled to common output shaft (combinations of two or more machines or engines 21/00)	7/06 . . . using only connecting-rods for conversion of reciprocatory into rotary motion or <u>vice versa</u>
1/12 . Separate cylinder-crankcase elements coupled together to form a unit	7/08 . . . . with side rods
<b>3/00 Reciprocating-piston machines or engines with cylinder axes coaxial with, or parallel or inclined to, main shaft axis</b>	7/10 . . . . having piston-rod of one piston passed through other piston
3/02 . with wobble-plate	7/12 . . . using rockers and connecting-rods
3/04 . the piston motion being transmitted by curved surfaces	7/14 . . acting on different main shafts
3/06 . . by multi-turn helical surfaces and automatic reversal	7/16 . with pistons synchronously moving in tandem arrangement

- 7/18 . with differential piston (7/20 takes precedence)
- 7/20 . with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other
- 9/00 Reciprocating-piston machines or engines characterised by connections between pistons and main shafts and not specific to preceding groups** (connections disengageable during idling 31/24)
- 9/02 . with crankshaft
- 9/04 . with rotary main shaft other than crankshaft
- 9/06 . . the piston motion being transmitted by curved surfaces
- 9/08 . . with ratchet and pawl
- 11/00 Reciprocating-piston machines or engines without rotary main shaft, e.g. of free-piston type**
- 11/02 . Equalising or cushioning devices
- 11/04 . Engines combined with reciprocatory driven devices, e.g. hammers (with pumps 23/08; predominating aspects of driven devices, see the relevant classes for the devices)
- 11/06 . . for generating vibration only
- 11/08 . with direct fluid transmission link (11/02 takes precedence)
- 13/00 Reciprocating-piston machines or engines with rotating cylinders in order to obtain the reciprocating-piston motion** (machines or engines of flexible-wall type 19/00) [2]
- 13/02 . with one cylinder only
- 13/04 . with more than one cylinder
- 13/06 . . in star arrangement
- 15/00 Reciprocating-piston machines or engines with movable cylinders other than provided for in group 13/00** (with movable cylinder sleeves for working-fluid control F 01 L)
- 15/02 . with reciprocating cylinders (with one piston within another 7/20)
- 15/04 . with oscillating cylinder
- 15/06 . . Control of working-fluid admission or discharge peculiar thereto
- 17/00 Reciprocating-piston machines or engines characterised by use of uniflow principle**
- 17/02 . Engines
- 17/04 . . Steam engines
- 19/00 Positive-displacement machines or engines of flexible-wall type**
- 19/02 . with plate-like flexible members
- 19/04 . with tubular flexible members
- 21/00 Combinations of two or more machines or engines** (23/00 takes precedence; combinations of two or more pumps F 04; fluid gearing F 16 H; regulating or controlling, see the relevant groups)
- 21/02 . the machines or engines being all of reciprocating-piston type
- 21/04 . the machines or engines being not all of reciprocating-piston type, e.g. of reciprocating steam engine with steam turbine
- 23/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (11/00 takes precedence; fluid gearing F 16 H; aspects predominantly concerning driven devices, see the relevant classes for these devices; regulating or controlling, see the relevant groups)
- 23/02 . Adaptations for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant classes for vehicles)
- 23/04 . . the vehicles being waterborne vessels
- 23/06 . Adaptations for driving, or combinations with, hand-held tools or the like
- 23/08 . Adaptations for driving, or combinations with, pumps
- 23/10 . Adaptations for driving, or combinations with, electric generators
- 23/12 . Adaptations for driving rolling mills or other heavy reversing machinery
- 25/00 Regulating, controlling, or safety means** (regulating or controlling in general G 05)
- 25/02 . Regulating or controlling by varying working-fluid admission or exhaust, e.g. by varying pressure or quantity (distributing or expansion valve gear F 01 L)
- 25/04 . . Sensing elements
- 25/06 . . . responsive to speed
- 25/08 . . Final actuators
- 25/10 . . . Arrangements or adaptations of working-fluid admission or discharge valves (valves in general F 16 K)
- 25/12 . . Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone 25/04; final actuators alone 25/08)
- 25/14 . . peculiar to particular kinds of machines or engines
- 25/16 . Safety means responsive to specific conditions (against water hammer or the like in steam engines 31/34)
- 25/18 . . preventing rotation in wrong direction
- 25/20 . Checking operation of safety devices
- 25/22 . Braking by redirecting working fluid
- 25/24 . . thereby regenerating energy
- 25/26 . Warning devices
- 27/00 Starting of machines or engines** (starting combustion engines F 02 N)
- 27/02 . of reciprocating-piston engines
- 27/04 . . by directing working-fluid supply, e.g. by aid of by-pass steam conduits
- 27/06 . . . specially for compound engines
- 27/08 . . Means for moving crank off dead-centre (turning-gear in general F 16 H)
- 29/00 Machines or engines with pertinent characteristics other than those provided for in preceding main groups**
- 29/02 . Atmospheric engines, i.e. atmosphere acting against vacuum

**F 01 B, C**

- |  |   |
|--|---|
| <p>29/04 . characterised by means for converting from one type to a different one</p> <p>29/06 . . from steam engine into combustion engine</p> <p>29/08 . Reciprocating-piston machines or engines not otherwise provided for</p> <p>29/10 . . Engines (refrigeration machines <a href="#">F 25 B</a>)</p> <p>29/12 . . . Steam engines (toy steam engines <a href="#">A 63 H 25/00</a>)</p> <p><b>31/00 Component parts, details, or accessories not provided for in, or of interest apart from, other groups</b> (machine or engine casings, other than those peculiar to steam engines, <a href="#">F 16 M</a>)</p> <p>31/02 . De-icing means for engines having icing phenomena</p> <p>31/04 . Means for equalising torque in reciprocating-piston machines or engines (compensation of inertial forces, suppression of vibration in systems <a href="#">F 16 F</a>)</p> <p>31/06 . Means for compensating relative expansion of component parts</p> <p>31/08 . Cooling of steam engines (cooling of fluid machines or engines in general <a href="#">F 01 P</a>); Heating; Heat insulation (heat insulation in general <a href="#">F 16 L 59/00</a>)</p> | <p>31/10 . Lubricating arrangements of steam engines (of fluid machines or engines in general <a href="#">F 01 M</a>)</p> <p>31/12 . Arrangements of measuring or indicating devices (warning apparatus <a href="#">25/26</a>; measuring instruments or the like <i>per se</i> <a href="#">G 01</a>)</p> <p>31/14 . Changing of compression ratio</p> <p>31/16 . Silencers specially adapted for steam engines (arrangements of exhaust pipes or tubes on steam engines <a href="#">31/30</a>; gas-flow silencers or exhaust silencers for machines or engines in general <a href="#">F 01 N</a>)</p> <p>31/18 . Draining</p> <p>31/20 . . of cylinders</p> <p>31/22 . Idling devices, e.g. having by-passing valves</p> <p>31/24 . . Disengagement of connections between pistons and main shafts</p> <p>31/26 . Other component parts, details, or accessories, peculiar to steam engines</p> <p>31/28 . . Cylinders or cylinder covers</p> <p>31/30 . . Arrangements of steam conduits</p> <p>31/32 . . Arrangements or adaptations of vacuum breakers</p> <p>31/34 . . Safety means against water hammer or against the penetration of water (steam traps <a href="#">F 16 T</a>)</p> <p>31/36 . . . automatically cutting-off steam supply</p> |
|--|---|

**F 01 C ROTARY-PISTON OR OSCILLATING-PISTON MACHINES OR ENGINES** (internal-combustion aspects [F 02 B 53/00](#), [55/00](#))**Notes**

- (1) This subclass covers:
- rotary-piston or oscillating-piston engines for elastic fluids, e.g. steam;
  - rotary-piston or oscillating-piston engines for liquids and elastic fluids;
  - rotary-piston or oscillating-piston machines for elastic fluids;
  - rotary-piston or oscillating-piston machines for liquids and elastic fluids.
- (2) In this subclass, the following expression is used with the meaning indicated:
- “rotary-piston machine” includes the German expressions “Drehkolbenmaschinen”, “Kreiskolbenmaschinen”, and “Umlaufkolbenmaschinen”.
- (3) Attention is drawn to the Notes preceding class [F 01](#), especially as regards the definitions of “rotary-piston machine”, “oscillating-piston machine”, “rotary piston”, “co-operating members”, “movement of co-operating members”, “teeth or tooth-equivalents” and “internal-axis”.

**Subclass Index****MACHINES OR ENGINES**

- With rotary pistons ..... [1/00](#) to [7/00](#)
- With oscillating pistons ..... [9/00](#)

**COMBINATIONS OR ADAPTATIONS OF**

- MACHINES OR ENGINES ..... [11/00](#), [13/00](#)
- DRIVE OF CO-OPERATING MEMBERS;
- SEALING ARRANGEMENTS ..... [17/00](#); [19/00](#)
- OTHER DETAILS OR ACCESSORIES ..... [21/00](#)

**1/00 Rotary-piston machines or engines** (with axes of co-operating members non-parallel 3/00; with the working-chamber walls at least partly resiliently deformable 5/00; with fluid ring or the like 7/00; rotary-piston machines or engines in which the working fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F 01 B 13/00)

### Note

Group 1/30 takes precedence over groups 1/02 to 1/28.

1/02 . . . of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents

1/04 . . . of internal-axis type

1/06 . . . of other than internal-axis type (1/063 takes precedence)

1/063 . . . with coaxially-mounted members having continuously-changing circumferential spacing between them [3]

1/067 . . . . having cam-and-follower type drive [3]

1/07 . . . . having crankshaft-and-connecting-rod type drive [3]

1/073 . . . . having pawl-and-ratchet type drive [3]

1/077 . . . . having toothed-gearing type drive [3]

1/08 . . . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

1/10 . . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member

1/107 . . . . with helical teeth [3]

1/113 . . . . the inner member carrying rollers intermeshing with the outer member [3]

1/12 . . . of other than internal-axis type

1/14 . . . . with toothed rotary pistons

1/16 . . . . . with helical teeth, e.g. chevron-shaped, screw type

1/18 . . . . . with similar tooth forms (1/16 takes precedence)

1/20 . . . . . with dissimilar tooth forms (1/16 takes precedence)

1/22 . . . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member

1/24 . . . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions

1/26 . . . of internal-axis type

1/28 . . . of other than internal-axis type

1/30 . . . having the characteristics covered by two or more of groups 1/02, 1/08, 1/22, 1/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members

1/32 . . . having both the movement defined in group 1/02 and relative reciprocation between the co-operating members

1/324 . . . . with vanes hinged to the inner member and reciprocating with respect to the outer member [3]

1/328 . . . . . and hinged to the outer member [3]

1/332 . . . . with vanes hinged to the outer member and reciprocating with respect to the inner member [3]

1/336 . . . . . and hinged to the inner member [3]

1/34 . . . having the movement defined in group 1/08 or 1/22 and relative reciprocation between the co-operating members

1/344 . . . . with vanes reciprocating with respect to the inner member [3]

1/348 . . . . . the vanes positively engaging, with circumferential play, an outer rotatable member [3]

1/352 . . . . . the vanes being pivoted on the axis of the outer member [3]

1/356 . . . . with vanes reciprocating with respect to the outer member [3]

1/36 . . . having both the movements defined in groups 1/22 and 1/24

1/38 . . . having the movement defined in group 1/02 and having a hinged member (1/32 takes precedence) [3]

1/39 . . . . with vanes hinged to the inner as well as to the outer member [3]

1/40 . . . having the movement defined in group 1/08 or 1/22 and having a hinged member

1/44 . . . . with vanes hinged to the inner member [3]

1/46 . . . . with vanes hinged to the outer member [3]

**3/00 Rotary-piston machines or engines with non-parallel axes of movement of co-operating members** (with the working-chamber walls being at least partly resiliently deformable 5/00)

3/02 . . . the axes being arranged at an angle of 90°

3/04 . . . with axially-sliding vanes

3/06 . . . the axes being arranged otherwise than at an angle of 90°

3/08 . . . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing

**5/00 Rotary-piston machines or engines with the working-chamber walls at least partly resiliently deformable**

5/02 . . . the resiliently-deformable wall being part of the inner member, e.g. of a rotary piston

5/04 . . . the resiliently-deformable wall being part of the outer member, e.g. of a housing

5/06 . . . the resiliently-deformable wall being a separate member

5/08 . . . of tubular form, e.g. hose

**7/00 Rotary-piston machines or engines with fluid ring or the like**

**9/00 Oscillating-piston machines or engines**

**11/00 Combinations of two or more machines or engines, each being of rotary-piston or oscillating-piston type** (13/00 takes precedence; combinations of two or more pumps F 04; fluid gearing F 16 H)

**F 01 C, D**

- 13/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (aspects predominantly concerning driven devices, see the relevant classes for these devices)
- 13/02 . for driving hand-held tools or the like
- 13/04 . for driving pumps or compressors
- 17/00 Arrangements for drive of co-operating members, e.g. for rotary piston and casing**
- 17/02 . of toothed-gearing type (1/077 takes precedence) [3]
- 17/04 . of cam-and-follower type (1/067 takes precedence) [3]
- 17/06 . using cranks, universal joints, or similar elements (1/07 takes precedence) [3]
- 19/00 Sealing arrangements in rotary-piston machines or engines** (sealings in general F 16 J)
- 19/02 . Radially-movable sealings for working fluids
- 19/04 . . of rigid material
- 19/06 . . of resilient material
- 19/08 . Axially-movable sealings for working fluids
- 19/10 . Sealings for working fluids between radially and axially movable parts
- 19/12 . for other than working fluid
- 21/00 Component parts, details, or accessories, not provided for in, or of interest apart from, other groups**
- 21/02 . Arrangements of bearings (bearing constructions F 16 C)
- 21/04 . Lubrication (of machines or engines in general F 01 M)
- 21/06 . Heating; Cooling (of machines or engines in general F 01 P); Heat insulation (heat insulation in general F 16 L)
- 21/08 . Rotary pistons (reciprocating pistons in general F 16 J)
- 21/10 . Outer members for co-operation with rotary pistons; Casings (casings for rotary engines or machines in general F 16 M)
- 21/12 . Control of working-fluid admission or discharge (suitable for more general application F 01 L)
- 21/14 . . for variable fluid distribution
- 21/16 . Other regulation or control

**F 01 D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (machines or engines for liquids F 03; non-positive-displacement pumps F 04 D)

**Notes**

- (1) This subclass covers:
  - non-positive-displacement engines for elastic fluids, e.g. steam turbines;
  - non-positive-displacement engines for liquids and elastic fluids;
  - non-positive-displacement machines for elastic fluids;
  - non-positive-displacement machines for liquids and elastic fluids.
- (2) Attention is drawn to the Notes preceding class F 01, especially as regards the definitions of “reaction type”, e.g. with airfoil-like blades, and “impulse type”, e.g. bucket turbines.

**Subclass Index**

NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES General characteristics; with axial-thrust balancing; with other than pure rotation ..... 1/00; 3/00; 23/00 Component parts blades and carrying members, protection thereof; rotors with adjustable blades; stators ..... 5/00; 7/00; 9/00	means against internal leakage ..... 11/00 COMBINATIONS OR ADAPTATIONS OF MACHINES OR ENGINES ..... 13/00, 15/00 REGULATION, CONTROLLING, SAFETY MEANS ..... 17/00, 19/00, 21/00 STARTING; SHUTTING-DOWN ..... 19/00; 21/00 OTHER DETAILS AND ACCESSORIES ..... 25/00
---	---

- 1/00 Non-positive-displacement machines or engines, e.g. steam turbines** (with working-fluid flows in opposite axial directions for balancing axial thrust 3/02; with other than pure rotation 23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor F 01 K)
- 1/02 . with stationary working-fluid guiding means and bladed or like rotor (1/24 takes precedence; without working-fluid guiding means 1/18) [5]
- 1/04 . . traversed by the working-fluid substantially axially
- 1/06 . . traversed by the working-fluid substantially radially
- 1/08 . . . having inward flow
- 1/10 . . having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (1/12 takes precedence)
- 1/12 . . with repeated action on same blade ring
- 1/14 . . . traversed by the working-fluid substantially radially

- 1/16 . . characterised by having both reaction stages and impulse stages
- 1/18 . without working-fluid guiding means (1/24, 1/32, 1/34 take precedence) [5]
- 1/20 . . traversed by the working-fluid substantially axially
- 1/22 . . traversed by the working-fluid substantially radially
- 1/24 . characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like
- 1/26 . . traversed by the working-fluid substantially axially
- 1/28 . . traversed by the working-fluid substantially radially
- 1/30 . characterised by having a single rotor operable in either direction of rotation, e.g. by reversing of blades (combinations of machines or engines 13/00)
- 1/32 . with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor
- 1/34 . characterised by non-bladed rotor, e.g. with drilled holes (1/32 takes precedence; sirens G 10 K 7/00) [5]
- 1/36 . . using fluid friction
- 1/38 . . of the screw type [5]
- 3/00 Machines or engines with axial-thrust balancing effected by working fluid**
- 3/02 . characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction
- 3/04 . axial thrust being compensated by thrust-balancing dummy piston or the like
- 5/00 Blades; Blade-carrying members (nozzle boxes 9/02); Heating, heat-insulating, cooling, or antivibration means on the blades or the members**
- 5/02 . Blade-carrying members, e.g. rotors (rotors of non-bladed type 1/34; stators 9/00)
- 5/03 . . Annular blade-carrying members having blades on the inner periphery of the annulus and extending inwardly radially, i.e. inverted rotors [6]
- 5/04 . . for radial-flow machines or engines
- 5/06 . . Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections
- 5/08 . . Heating, heat-insulating, or cooling means
- 5/10 . . Antivibration means
- 5/12 . Blades (blade roots 5/30; rotors with blades adjustable in operation 7/00; stator blades 9/02)
- 5/14 . . Form or construction (selecting particular materials, measures against erosion or corrosion 5/28)
- 5/16 . . . for counteracting blade vibration
- 5/18 . . . Hollow blades; Heating, heat-insulating, or cooling means on blades
- 5/20 . . . Specially-shaped blade tips to seal space between tips and stator
- 5/22 . . Blade-to-blade connections, e.g. by shrouding
- 5/24 . . . using wire or the like
- 5/26 . . Antivibration means not restricted to blade form or construction or to blade-to-blade connections
- 5/28 . . Selecting particular materials; Measures against erosion or corrosion
- 5/30 . Fixing blades to rotors; Blade roots
- 5/32 . . Locking, e.g. by final locking-blades or keys
- 5/34 . Rotor-blade aggregates of unitary construction
- 7/00 Rotors with blades adjustable in operation; Control thereof (for reversing 1/30)**
- 7/02 . having adjustment responsive to speed
- 9/00 Stators (non-fluid guiding aspects of casings, regulating, controlling, or safety aspects, see the relevant groups)**
- 9/02 . Nozzles; Nozzle boxes; Stator blades; Guide conduits
- 9/04 . . forming ring or sector
- 9/06 . Fluid supply conduits to nozzles or the like
- 11/00 Preventing or minimising internal leakage of working fluid, e.g. between stages (sealings in general F 16 J)**
- 11/02 . by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator 11/08)
- 11/04 . . using sealing fluid, e.g. steam
- 11/06 . . . Control thereof
- 11/08 . for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor 5/20) [6]
- 11/10 . . using sealing fluid, e.g. steam
- 11/12 . . using a rubstrip, e.g. erodible, deformable or resiliently biased part [6]
- 11/14 . . Adjusting or regulating tip-clearance, i.e. distance between rotor-blade tips and stator casing (rotors with blades adjustable in operation 7/00) [6]
- 11/16 . . . by self-adjusting means (11/12 takes precedence) [6]
- 11/18 . . . . using stator or rotor components with predetermined thermal response, e.g. selective insulation, thermal inertia, differential expansion [6]
- 11/20 . . . . Actively adjusting tip-clearance [6]
- 11/22 . . . . by mechanically actuating the stator or rotor components, e.g. moving shroud sections relative to the rotor [6]
- 11/24 . . . . by selectively cooling or heating stator or rotor components [6]
- 13/00 Combinations of two or more machines or engines (15/00 takes precedence; combinations of two or more pumps F 04; fluid gearing F 16 H; regulating or controlling, see the relevant groups)**
- 13/02 . Working-fluid interconnection of machines or engines

**F 01 D****15/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (regulating or controlling, see the relevant groups; aspects predominantly concerning driven devices, see the relevant classes for the devices)

- 15/02 . Adaptations for driving vehicles, e.g. locomotives (arrangement in vehicles, see the relevant vehicle classes)
- 15/04 . . the vehicles being waterborne vessels
- 15/06 . Adaptations for driving, or combinations with, hand-held tools or the like
- 15/08 . Adaptations for driving, or combinations with, pumps
- 15/10 . Adaptations for driving, or combinations with, electric generators
- 15/12 . Combinations with mechanical gearing (driven by multiple engines [13/00](#))

**17/00 Regulating or controlling by varying flow** (for reversing [1/30](#); by varying rotor blade position [7/00](#); specially for starting [19/00](#); shutting-down [21/00](#); regulating or controlling in general [G 05](#))

- 17/02 . Arrangement of sensing elements (sensing elements per se, see the relevant subclasses)
- 17/04 . . responsive to load
- 17/06 . . responsive to speed
- 17/08 . . responsive to condition of working fluid, e.g. pressure
- 17/10 . Final actuators (valves in general [F 16 K](#))
- 17/12 . . arranged in stator parts
- 17/14 . . . varying effective cross-sectional area of nozzles or guide conduits
- 17/16 . . . . by means of nozzle vanes
- 17/18 . . . varying effective number of nozzles or guide conduits
- 17/20 . Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone [17/02](#); final actuators alone [17/10](#))
- 17/22 . . the operation or power assistance being predominantly non-mechanical
- 17/24 . . . electrical
- 17/26 . . . fluid, e.g. hydraulic

**19/00 Starting of machines or engines; Regulating, controlling, or safety means in connection therewith** (warming-up before starting [25/10](#); turning or inching gear [25/34](#))

- 19/02 . dependent on temperature of component parts, e.g. of turbine casing

**21/00 Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for**

- 21/02 . Shutting-down responsive to overspeed
- 21/04 . responsive to undesired position of rotor relative to stator, e.g. indicating such position
- 21/06 . . Shutting-down
- 21/08 . . Restoring position
- 21/10 . responsive to unwanted deposits on blades, in working-fluid conduits, or the like
- 21/12 . responsive to temperature
- 21/14 . responsive to other specific conditions
- 21/16 . Trip gear
- 21/18 . . involving hydraulic means
- 21/20 . Checking operation of shut-down devices

**23/00 Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type****25/00 Component parts, details, or accessories, not provided for in, or of interest apart from, other groups**

- 25/02 . De-icing means for engines having icing phenomena
- 25/04 . Antivibration arrangements
- 25/06 . . for preventing blade vibration (means on blade-carrying members or blades [5/00](#))
- 25/08 . Cooling (of machines or engines in general [F 01 P](#)); Heating; Heat insulation (of blade-carrying members, of blades [5/00](#))
- 25/10 . . Heating, e.g. warming-up before starting
- 25/12 . . Cooling
- 25/14 . . Casings modified therefor (double casings [25/26](#))
- 25/16 . Arrangement of bearings; Supporting or mounting bearings in casings (bearings per se [F 16 C](#))
- 25/18 . Lubricating arrangements (of machines or engines in general [F 01 M](#))
- 25/20 . . using lubrication pumps
- 25/22 . . using working fluid or other gaseous fluid as lubricant
- 25/24 . Casings (modified for heating or cooling [25/14](#)); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general [F 16 M](#))
- 25/26 . . Double casings; Measures against temperature strain in casings
- 25/28 . Supporting or mounting arrangements, e.g. for turbine casing
- 25/30 . Exhaust heads, chambers, or the like
- 25/32 . Collecting of condensation water; Drainage
- 25/34 . Turning or inching gear
- 25/36 . . using electric motors

**F 01 K STEAM ENGINE PLANTS; STEAM ACCUMULATORS; ENGINE PLANTS NOT OTHERWISE PROVIDED FOR; ENGINES USING SPECIAL WORKING FLUIDS OR CYCLES** (gas-turbine or jet-propulsion plants **F 02**; steam generation **F 22**; nuclear power plants, engine arrangements therein **G 21 D**)

### Note

Attention is drawn to the Notes preceding class **F 01**, especially as regards the definitions of “steam” and “special vapour”.

### Subclass Index

#### STEAM ENGINE PLANTS

Characterised by the use of  
 accumulators or heaters;  
 storing means in alkali;  
 specific types of engines..... 3/00; 5/00; 7/00  
 special steam systems, cycles,  
 or processes .....7/00  
 Characterised by the disposition of  
 condenser; structural  
 combination of engine and  
 boiler or condenser .....9/00; 11/00  
 Not otherwise provided for .....21/00  
 General layout or operation;  
 adaptations for special use .....13/00; 15/00

#### Utilisation of steam

for feed-water heating; in the  
 regeneration or other treating;  
 for other purposes.....7/34; 19/00; 17/00

#### ENGINE PLANTS NOT RESTRICTED TO STEAM UTILISATION

With several engines driven by  
 different fluids .....23/00

Not otherwise provided for, other  
 types with special working fluids or  
 working with enclosed cycles .....25/00, 27/00

#### STEAM ACCUMULATORS.....1/00

#### SPECIAL TYPES OF ENGINES

Steam engines .....7/00  
 Other than steam.....25/00

- 1/00 Steam accumulators** (use of accumulators in steam engine plants 3/00)
- 1/02 . for storing steam otherwise than in a liquid
  - 1/04 . for storing steam in a liquid, e.g. Ruth type (in alkali to increase steam pressure **F 22 B 1/20**)
  - 1/06 . . Internal fittings facilitating steam distribution, steam formation, or circulation (acting during charging or discharging **1/08**; fittings facilitating circulation through multiple accumulators **1/14**)
  - 1/08 . Charging or discharging of accumulators with steam (peculiar to multiple accumulators **1/12**)
  - 1/10 . specially adapted for superheated steam
  - 1/12 . Multiple accumulators; Charging, discharging, or regulating peculiar thereto
  - 1/14 . . Circulation
  - 1/16 . Other safety or regulating means
  - 1/18 . . for steam pressure
  - 1/20 . Other steam-accumulator parts, details, or accessories

#### Steam engine plants

- 3/00 Plants characterised by the use of steam or heat accumulators, or intermediate steam heaters, therein** (regenerating exhaust steam **19/00**)
- 3/02 . Use of accumulators and specific engine types; Regulating thereof
  - 3/04 . . the engine being of multiple-inlet-pressure type
  - 3/06 . . the engine being of extraction or non-condensing type
  - 3/08 . Use of accumulators, the plant being specially adapted for a specific use
  - 3/10 . . for vehicle drive, e.g. for accumulator locomotives
  - 3/12 . having two or more accumulators
  - 3/14 . having both steam accumulator and heater, e.g. superheating accumulator (steam superheaters per se **F 22 G**)
  - 3/16 . . Mutual arrangement of accumulator and heater
  - 3/18 . having heaters (having both steam accumulator and heater **3/14**; steam heaters per se **F 22**)
  - 3/20 . . with heating by combustion gases of main boiler
  - 3/22 . . . Controlling, e.g. starting, stopping
  - 3/24 . . with heating by separately-fired heaters
  - 3/26 . . with heating by steam

- 5/00 Plants characterised by use of means for storing steam in an alkali to increase steam pressure, e.g. of Honigmann or Koenemann type**
- 5/02 . used in regenerative installation
- 7/00 Plants characterised by the use of specific types of engine (3/02 takes precedence); Plants or engines characterised by their use of special steam systems, cycles, or processes (reciprocating-piston engines using uniflow principle F 01 B 17/04); Regulating means peculiar to such systems, cycles, or processes; Use of withdrawn or exhaust steam for feed-water heating**
- 7/02 . the engines being of multiple-expansion type (the engines being only of turbine type 7/16; the engines using steam of critical or over-critical pressure 7/32; the engines being of extraction or non-condensing type 7/34)
  - 7/04 . . Regulating means peculiar thereto
  - 7/06 . the engines being of multiple-inlet-pressure type (7/02 takes precedence; the engines being only of turbine type 7/16; the engines using steam of critical or over-critical pressure 7/32; the engines being of extraction or non-condensing type 7/34)
  - 7/08 . . Regulating means peculiar thereto
  - 7/10 . characterised by the engine exhaust pressure (the engines being only of turbine type 7/16; the engines using steam of critical or over-critical pressure 7/32; the engines being of extraction or non-condensing type 7/34)
  - 7/12 . . of condensing type
  - 7/14 . . . Regulating means peculiar thereto
  - 7/16 . the engines being only of turbine type (the engines using steam of critical or over-critical pressure 7/32; the engines being of extraction or non-condensing type 7/34)
  - 7/18 . . the turbine being of multiple-inlet-pressure type
  - 7/20 . . . Regulating means peculiar thereto
  - 7/22 . . the turbines having inter-stage steam heating
  - 7/24 . . . Regulating or safety means peculiar thereto
  - 7/26 . . the turbines having inter-stage steam accumulation
  - 7/28 . . . Regulating means peculiar thereto
  - 7/30 . . the turbines using exhaust steam only
  - 7/32 . the engines using steam of critical or over-critical pressure
  - 7/34 . the engines being of extraction or non-condensing type; Use of steam for feed-water heating (feed-water heaters in general F 22 D)
  - 7/36 . . the engines being of positive-displacement type
- 7/38 . . the engines being of turbine type
- 7/40 . . Use of two or more feed-water heaters in series
- 7/42 . . Use of desuperheaters for feed-water heating
- 7/44 . . Use of steam for feed-water heating and another purpose
- 9/00 Plants characterised by condensers arranged or modified to co-operate with the engines (by condensers structurally combined with engines 11/00; steam condensers per se F 28 B)**
- 9/02 . Arrangements or modifications of condensate or air pumps
  - 9/04 . with dump valves to by-pass stages
- 11/00 Plants characterised by the engines being structurally combined with boilers or condensers**
- 11/02 . the engines being turbines
  - 11/04 . the boilers or condensers being rotated in use
- 13/00 General layout or general methods of operation, of complete plants**
- 13/02 . Regulating, e.g. stopping or starting
- 15/00 Adaptations of plants for special use**
- 15/02 . for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant vehicle classes)
  - 15/04 . . the vehicles being waterborne vessels
- 17/00 Use of steam or condensate extracted or exhausted from steam engine plant (for heating feed-water 7/34; returning condensate to boiler F 22 D)**
- 17/02 . for heating purposes, e.g. industrial, domestic (17/06 takes precedence; domestic- or space-heating systems, e.g. central-heating systems, in general F 24 D 1/00, 3/00, 9/00) [3]
  - 17/04 . for specific purposes other than heating (17/06 takes precedence)
  - 17/06 . Returning energy of steam, in exchanged form, to process, e.g. use of exhaust steam for drying solid fuel of plant
- 19/00 Regenerating or otherwise treating steam exhaust from steam engine plant (plants characterised by use of means for storing steam in an alkali to increase steam pressure 5/00; returning condensate to boiler F 22 D)**
- 19/02 . Regenerating by compression
  - 19/04 . . in combination with cooling or heating
  - 19/06 . . in engine cylinder

- 19/08 . . . compression done by injection apparatus, jet blower, or the like
- 19/10 . . . Cooling exhaust steam other than by condenser; Rendering exhaust steam invisible
- 21/00 Steam engine plants not otherwise provided for**
- 21/02 . . . with steam generation in engine cylinders
- 21/04 . . . using mixtures of steam and gas; Plants generating or heating steam by bringing water or steam into direct contact with hot gas (direct-contact steam generators in general [F 22 B](#))
- 21/06 . . . Treating live steam, other than thermodynamically, e.g. for fighting deposits in engine
- 
- 23/00 Plants characterised by more than one engine delivering power external to the plant, the engines being driven by different fluids**
- 23/02 . . . the engine cycles being thermally coupled
- 23/04 . . . condensation heat from one cycle heating the fluid in another cycle
- 23/06 . . . combustion heat from one cycle heating the fluid in another cycle
- 23/08 . . . with working fluid of one cycle heating the fluid in another cycle
- 23/10 . . . with exhaust fluid of one cycle heating the fluid in another cycle
- 23/12 . . . the engines being mechanically coupled ([23/02](#) takes precedence)
- 23/14 . . . including at least one combustion engine
- 23/16 . . . all the engines being turbines ([23/14](#) takes precedence)
- 23/18 . . . characterised by adaptation for specific use
- 25/00 Plants or engines characterised by use of special working fluids, not otherwise provided for; Plants operating in closed cycles and not otherwise provided for**
- 25/02 . . . the fluid remaining in the liquid phase
- 25/04 . . . the fluid being in different phases, e.g. foamed
- 25/06 . . . using mixtures of different fluids (plants using mixtures of steam and gas [21/04](#))
- 25/08 . . . using special vapours
- 25/10 . . . the vapours being cold, e.g. ammonia, carbon dioxide, ether
- 25/12 . . . the vapours being metallic, e.g. mercury
- 25/14 . . . using industrial or other waste gases
- 27/00 Plants for converting heat or fluid energy into mechanical energy, not otherwise provided for**
- 27/02 . . . Plants modified to use their waste heat, other than that of exhaust, e.g. engine-friction heat

## F 01 L CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES (valves in general [F 16 K](#))

### Notes

- (1) Attention is drawn to the Notes preceding class [F 01](#), especially Note (3).
- (2) As regards the above-mentioned Note (3), attention is drawn to [F 01 B 3/10](#), [15/06](#), [F 01 C 21/12](#), [F 02 B 53/06](#), [F 03 C 1/08](#), [F 04 B 1/18](#), [7/00](#), [39/08](#), [39/10](#), and [F 04 C 15/02](#), [29/08](#).

### Subclass Index

#### VALVE-GEAR OR VALVE ARRANGEMENTS IN GENERAL

General features .....	1/00
Operation	
mechanical.....	1/00
non-mechanical .....	9/00
Lift valves .....	3/00
Slide valves .....	5/00, 7/00
Arrangements in piston or piston-rod.....	11/00
Modified to facilitate engine operations.....	13/00

#### VALVE-GEAR OR VALVE ARRANGEMENTS FOR VARIABLE WORKING-FLUID DISTRIBUTION

General features.....	1/00
With slide valves	
surrounding cylinder or piston .....	17/00
with rotary or oscillatory motion; combined .....	33/00; 19/00
other features.....	15/00
With lift valves.....	35/00
Arrangements with particular characteristics; reversing gear.....	21/00 to 27/00; 29/00
Other valve-gear or valve arrangements.....	15/00
Drive, control, or adjustment .....	25/00, 31/00

**Valve-gear for internal-combustion piston engines or for other machines or engines with positive working-fluid displacement**

(valve-gear specially for steam engines or specially for other machines or engines with variable fluid distribution 15/00 to 35/00)

- 1/00 Valve-gear or valve arrangements, e.g. lift-valve gear** (lift valve and valve seat assemblies *per se* 3/00; slide-valve gear 5/00; actuated non-mechanically 9/00; valve arrangements in working piston or piston-rod 11/00; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations 13/00)
- 1/02 . Valve drive (transmitting-gear between valve drive and valve 1/12)
- 1/04 . . by means of cams, camshafts, cam discs, eccentrics, or the like (1/10 takes precedence)
- 1/047 . . . Camshafts [6]
- 1/053 . . . . overhead type [6]
- 1/06 . . . the cams, or the like, rotating at a higher speed than that corresponding to the valve cycle, e.g. operating four-stroke engine valves directly from crankshaft
- 1/08 . . . Shape of cams
- 1/10 . . by means of crank- or eccentric-driven rods
- 1/12 . Transmitting-gear between valve drive and valve (simultaneously operating two or more valves 1/26)
- 1/14 . . Tappets; Push-rods
- 1/16 . . . Silencing impact; Reducing wear
- 1/18 . . Rocking arms or levers
- 1/20 . Adjusting or compensating clearance, i.e. lash adjustment
- 1/22 . . automatically
- 1/24 . . . by fluid means, e.g. hydraulically
- 1/245 . . . . Hydraulic tappets [6]
- 1/25 . . . . between cam and valve stem [6]
- 1/255 . . . . between cam and rocker arm [6]
- 1/26 . characterised by the provision of two or more valves operated simultaneously by same transmitting-gear; peculiar to machines or engines with more than two lift valves per cylinder (with coaxial valves 1/28)
- 1/28 . characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports
- 1/30 . characterised by the provision of positively opened and closed valves, i.e. desmodromic valves
- 1/32 . characterised by the provision of means for rotating lift valves, e.g. to diminish wear
- 1/34 . characterised by the provision of means for changing the timing of the valves without changing the duration of opening
- 1/344 . . changing the angular relationship between crankshaft and camshaft, e.g. using helicoidal gear [6]
- 1/348 . . . by means acting on timing belts or chains [6]
- 1/352 . . . using bevel or epicyclic gear [6]

- 1/356 . . . making the angular relationship oscillate [6]
- 1/36 . peculiar to machines or engines of specific type other than four-stroke cycle
- 1/38 . . for engines with other than four-stroke cycle, e.g. with two-stroke cycle (1/26, 1/28 take precedence)
- 1/40 . . for engines with scavenging charge near top dead-centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects F 02 B)
- 1/42 . . for machines or engines characterised by cylinder arrangement, e.g. star or fan
- 1/44 . Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves
- 1/46 . Component parts, details, or accessories, not provided for in preceding subgroups
- 3/00 Lift valves, i.e. cut-off apparatus with closure members having at least a component of their opening and closing motion perpendicular to the closing faces; Parts or accessories thereof**
- 3/02 . Selecting particular materials for valve members or valve seats; Valve members or valve seats composed of two or more materials
- 3/04 . . Coated valve members or valve seats
- 3/06 . Valve members or valve seats with means for guiding or deflecting the medium controlled thereby, e.g. producing a rotary motion of the drawn-in cylinder charge (for rotating lift valves 1/32)
- 3/08 . Valve guides; Sealing of valve stem, e.g. sealing by lubricant
- 3/10 . Connecting springs to valve members
- 3/12 . Cooling of valves
- 3/14 . . by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve
- 3/16 . . by means of a fluid flowing through or along valve, e.g. air (for sealing only 3/08)
- 3/18 . . . Liquid cooling of valve
- 3/20 . Shapes or constructions of valve members, not provided for in preceding subgroups of this group
- 3/22 . Valve seats not provided for in preceding subgroups of this group; Fixing of valve seats
- 3/24 . Safety means or accessories, not provided for in preceding subgroups of this group
- 5/00 Slide-valve gear or valve arrangements** (with pure rotary or oscillatory movement 7/00)
- 5/02 . with other than cylindrical, sleeve, or part-annularly-shaped valves, e.g. with flat-type valves
- 5/04 . with cylindrical, sleeve, or part-annularly-shaped valves
- 5/06 . . surrounding working cylinder or piston
- 5/08 . . . Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly-shaped valves 5/12)

- 5/10 . . . . with reciprocating and other movement of same valve
- 5/12 . . . Arrangements with part-annularly-shaped valves
- 5/14 . characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston 5/06)
- 5/16 . . with reciprocating and other movement of same valve, e.g. longitudinally and in cross direction of working cylinder
- 5/18 . . with reciprocatory valve and other slide valve
- 5/20 . specially for two-stroke engines (5/06, 5/14 take precedence)
- 5/22 . Multiple-valve arrangements (with valves surrounding working cylinder or piston 5/06; with reciprocatory and other slide valves 5/18; specially for two-stroke engines 5/20)
- 5/24 . Component parts, details, or accessories, not provided for in preceding subgroups of this group
  
- 7/00 Rotary or oscillatory slide-valve gear or valve arrangements** (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves 5/00)
  - 7/02 . with cylindrical, sleeve, or part-annularly-shaped valves (of disc type 7/06; of conical type 7/08)
  - 7/04 . . surrounding working cylinder or piston
  - 7/06 . with disc-type valves
  - 7/08 . with conically- or frusto-conically-shaped valves
  - 7/10 . with valves of other specific shape, e.g. spherical
  - 7/12 . specially for two-stroke engines (7/04 takes precedence)
  - 7/14 . Multiple-valve arrangements (with valves surrounding working cylinder or piston 7/04; specially for two-stroke engines 7/12)
  - 7/16 . Sealing or packing arrangements specially therefor
  - 7/18 . Component parts, details, or accessories, not provided for in preceding subgroups of this group
  
- 9/00 Valve-gear or valve arrangements actuated non-mechanically**
  - 9/02 . by fluid means, e.g. hydraulic
  - 9/04 . by electric means
  
- 11/00 Valve arrangements in working piston or piston-rod**
  - 11/02 . in piston
  - 11/04 . . operated by movement of connecting-rod
  - 11/06 . . . operating oscillatory valve
  
- 13/00 Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations**
  - 13/02 . for reversing
  - 13/04 . for starting by means of fluid pressure
  - 13/06 . for braking
  - 13/08 . for decompression, e.g. during starting; for changing compression ratio

**Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, specially for steam engines, or specially for other machines or engines with variable working-fluid distribution**

**Notes**

- (1) Groups 15/00 to 31/00 cover:
  - valve drive or means external to valves for adjustment during operation;
  - tripping-gear;
  - reversing-gear;
  - use of pistons or piston-rods as valves or as valve-supporting elements;
  - valve-gear or valve arrangements peculiar to free-piston machines or engines.
- (2) Groups 15/00 to 31/00 do not fully cover subject matter restricted to rotary, oscillatory, or lift-valve gear or valve arrangements, which is covered by group 33/00 or 35/00.
  
- 15/00 Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups 17/00 to 29/00** (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. 31/00; tripping-gear or tripping of valves 31/00)
  - 15/02 . with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves
  - 15/04 . . main valve being combined with auxiliary valve (of drag-valve type 15/10)
  - 15/06 . . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself
  - 15/08 . with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves
  - 15/10 . with main slide valve and auxiliary valve dragged thereby
  - 15/12 . characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling
  - 15/14 . Arrangements with several co-operating main valves, e.g. reciprocatory and rotary
  - 15/16 . . with reciprocatory slide valves only
  - 15/18 . Valve arrangements not provided for in preceding subgroups of this group
  - 15/20 . Component parts, details, or accessories, not provided for in preceding subgroups of this group
  
- 17/00 Slide-valve gear or valve arrangements with cylindrical, sleeve, or part-annularly-shaped valves surrounding working cylinder or piston**
  - 17/02 . Drive, or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other

**F 01 L, M**

**19/00** Slide-valve gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in group 17/00, e.g. longitudinally and in cross direction of working cylinder

19/02 . Drive, or adjustment during operation, peculiar thereto

**21/00** Use of working pistons or piston-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines

21/02 . Piston or piston-rod used as valve member

21/04 . Valves arranged in or on piston or piston-rod

**23/00** Valves controlled by impact of piston, e.g. in free-piston machines

**25/00** Drive, or adjustment during operation, of distribution or expansion valves by non-mechanical means

25/02 . by fluid means

25/04 . . by working fluid of machine or engine, e.g. free-piston machine

25/06 . . . Arrangements with main and auxiliary valves, at least one of them being fluid-driven

25/08 . by electric or magnetic means

**27/00** Distribution or expansion-valve gear peculiar to free-piston machines or engines and not provided for in groups 21/00 to 25/00

27/02 . the machine or engine having rotary or oscillatory valves

27/04 . Delayed-action controls, e.g. of cataract- or dash-pot-type

**29/00** Reversing-gear (equally usable for control of degree of working fluid admission, and reversing being of secondary importance 31/00)

29/02 . by displacing eccentric

29/04 . by links or guide rods

29/06 . by interchanging inlet and exhaust ports

29/08 . specially for rotary or oscillatory valves

29/10 . Details, e.g. drive

29/12 . . Powered reverse gear

**31/00** Valve drive, valve adjustment during operation, or other valve control, not provided for in groups 15/00 to 29/00 (sensing elements measuring the variable or condition to be controlled or regulated F 01 B)

31/02 . with tripping-gear (for oscillatory valves 31/06); Tripping of valves

31/04 . . with positively-driven trip levers

31/06 . with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type

31/08 . Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear

31/10 . . the drive being effected by eccentrics (31/14 takes precedence)

31/12 . . . Valve adjustment by displacing eccentric

31/14 . . Valve adjustment by links or guide rods, e.g. in valve-gears with eccentric drive

31/16 . . the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives

31/18 . . specially for rotary or oscillatory valves

31/20 . . . Valve adjustment

31/22 . . specially for lift valves

31/24 . . . Valve adjustment

**Rotary or oscillatory slide-valve gear or lift-valve gear or such valve arrangements specially for steam engines or specially for other machines or engines with variable working-fluid distribution** (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines 15/00 to 31/00)

**33/00** Rotary or oscillatory slide-valve gear or valve arrangements

33/02 . rotary

33/04 . oscillatory

**35/00** Lift-valve gear or valve arrangements

35/02 . Valves

35/04 . Arrangements of valves in the machine or engine, e.g. relative to working cylinder

---

**F 01 M** LUBRICATING OF MACHINES OR ENGINES IN GENERAL (lubricating in general F 16 N); LUBRICATING INTERNAL-COMBUSTION ENGINES; CRANKCASE VENTILATING [2]

**Note**

Attention is drawn to the Notes preceding class F 01, especially as regards Note (3).

**Subclass Index**

PRESSURE LUBRICATION.....	1/00
SPECIAL LUBRICATION .....	3/00, 7/00, 9/00
LUBRICANT CONDITIONING .....	5/00

DETAILS, ACCESSORIES.....	11/00
CRANKCASE VENTILATION .....	13/00

**1/00 Pressure lubrication**

- 1/02 . using lubricating pumps (pumps in general [F 04](#); lubricating pumps [per se F 16 N](#))
- 1/04 . using pressure in working cylinder or crankcase to operate lubricant-feeding devices
- 1/06 . Lubricating systems characterised by the provision therein of crankshafts or connecting-rods with lubricant passageways, e.g. bores (crankshafts, connecting-rods, [per se F 16 C](#))
- 1/08 . Lubricating systems characterised by the provision therein of lubricant-jetting means
- 1/10 . Lubricating systems characterised by the provision therein of lubricant venting or purifying means, e.g. of filters (mounting of, connecting of, or constructional details of lubricant purifying means [11/03](#))
- 1/12 . Closed-circuit lubricating systems not provided for in groups [1/02](#) to [1/10](#)
- 1/14 . Timed lubrication ([1/08](#) takes precedence)
- 1/16 . Controlling lubricant pressure or quantity (rendering machines or engines inoperative or idling on lubricant-pressure failure [1/22](#))
- 1/18 . Indicating or safety devices (concerning lubricant level [11/06](#), [11/12](#))
- 1/20 . . concerning lubricant pressure (measuring fluid pressure in general [G 01 L](#))
- 1/22 . . . rendering machines or engines inoperative or idling on pressure failure
- 1/24 . . . . acting on engine fuel system
- 1/26 . . . . acting on engine ignition system
- 1/28 . . . . acting on engine combustion-air supply

**3/00 Lubrication specially adapted for engines with crankcase compression of fuel-air mixture, or for other engines in which lubricant is contained in fuel, combustion air, or fuel-air mixture** (separating lubricant from air or fuel-air mixture before entry into cylinder [11/08](#))

- 3/02 . with variable proportion of lubricant to fuel, lubricant to air, or lubricant to fuel-air mixture
- 3/04 . for upper cylinder lubrication only

**5/00 Heating, cooling, or controlling temperature of lubricant** (arrangement of lubricant coolers in engine cooling system [F 01 P 11/08](#)); **Lubrication means facilitating engine starting**

- 5/02 . Conditioning lubricant for aiding engine starting, e.g. heating
- 5/04 . . Diluting, e.g. with fuel

**7/00 Lubrication means specially adapted for machine or engine running-in****9/00 Lubrication means having pertinent characteristics not provided for in, or of interest apart from, groups [1/00](#) to [7/00](#)**

- 9/02 . having means for introducing additives to lubricant
- 9/04 . Use of fuel as lubricant
- 9/06 . Dip or splash lubrication
- 9/08 . Drip lubrication
- 9/10 . Lubrication of valve gear or auxiliaries
- 9/12 . Non-pressurised lubrication, or non-closed-circuit lubrication, not otherwise provided for

**11/00 Component parts, details, or accessories, not provided for in, or of interest apart from, groups [1/00](#) to [9/00](#)**

- 11/02 . Arrangements of lubricant conduits
- 11/03 . Mounting or connecting of lubricant purifying means relative to the machine or engine; Details of lubricant purifying means (filters [B 01 D](#)) [3]
- 11/04 . Filling or draining lubricant of or from machines or engines
- 11/06 . Means for keeping lubricant level constant or for accommodating movement or position of machines or engines
- 11/08 . Separating lubricant from air or fuel-air mixture before entry into cylinder (separating in general [B 01 D](#))
- 11/10 . Indicating devices; Other safety devices
- 11/12 . . concerning lubricant level (level indicators in general [G 01 F 23/00](#))

**13/00 Crankcase ventilating or breathing [2]**

- 13/02 . by means of additional source of positive or negative pressure [2]
- 13/04 . having means for purifying air before leaving crankcase, e.g. removing oil [2]
- 13/06 . specially adapted for submersible engines, e.g. of armoured vehicles [2]

**F 01 N GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL-COMBUSTION ENGINES** (arrangements in connection with gas exhaust of propulsion units in vehicles [B 60 K 13/00](#); combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines [F 02 M 35/00](#); protecting against, or damping, noise in general [G 10 K 11/16](#))

### Note

Attention is drawn to the Notes preceding class [F 01](#), especially as regards Note (3).

- 
- 1/00 Silencing apparatus characterised by method of silencing**
- 1/02 . by using resonance
  - 1/04 . . having sound-absorbing materials in resonance chambers
  - 1/06 . by using interference effect
  - 1/08 . by reducing exhaust energy by throttling or whirling
  - 1/10 . . in combination with sound-absorbing materials
  - 1/12 . . using spirally- or helically-shaped channels ([1/10](#) takes precedence; cyclones [B 04 C](#))
  - 1/14 . by adding air to exhaust gases
  - 1/16 . by using movable parts
  - 1/18 . . having rotary movement
  - 1/20 . . having oscillating or vibrating movement (the parts being resilient walls [1/22](#))
  - 1/22 . . the parts being resilient walls
  - 1/24 . by using sound-absorbing materials ([1/04](#), [1/06](#), [1/10](#), [1/14](#), [1/16](#) take precedence)
- 3/00 Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust** (electric control [9/00](#); monitoring or diagnostic devices for exhaust-gas treatment apparatus [11/00](#)) [[4](#)]
- 3/01 . by means of electric or electrostatic separators [[7](#)]
  - 3/02 . for cooling, or for removing solid constituents of, exhaust (by means of electric or electrostatic separators [3/01](#)) [[1,7](#)]
  - 3/021 . . by means of filters [[7](#)]
  - 3/022 . . . characterised by specially adapted filtering structure, e.g. honeycomb, mesh or fibrous [[7](#)]
  - 3/023 . . . using means for regenerating the filters, e.g. by burning trapped particles [[7](#)]
  - 3/025 . . . . using fuel burner or by adding fuel to exhaust [[7](#)]
  - 3/027 . . . . using electric or magnetic heating [[7](#)]
  - 3/028 . . . . using microwaves [[7](#)]
  - 3/029 . . . . by adding non-fuel substances to exhaust [[7](#)]
  - 3/031 . . . having means for by-passing filters, e.g. when clogged or during cold engine start [[7](#)]
  - 3/032 . . . . during filter regeneration only [[7](#)]
  - 3/033 . . . . in combination with other devices [[7](#)]
  - 3/035 . . . . with catalytic reactors [[7](#)]
  - 3/037 . . by means of inertial or centrifugal separators, e.g. associated with agglomerators [[7](#)]
  - 3/038 . . by means of perforated plates defining expansion chambers associated with condensation and collection chambers [[7](#)]
  - 3/04 . . by means of liquids
  - 3/05 . . by means of air, e.g. by mixing exhaust with air (silencers working by addition of air to exhaust [1/14](#); arrangements for the supply of additional air for the thermal or catalytic conversion of noxious components of exhaust [3/30](#)) [[7](#)]
  - 3/06 . for extinguishing sparks
  - 3/08 . for rendering innocuous (using electric or electrostatic separators [3/01](#); chemical aspects [B 01 D 53/92](#)) [[1,7](#)]
  - 3/10 . . by thermal or catalytic conversion of noxious components of exhaust [[3](#)]
  - 3/18 . . . characterised by methods of operation; Regulation [[3](#)]
  - 3/20 . . . . specially adapted for catalytic conversion ([3/22](#) takes precedence) [[3](#)]
  - 3/22 . . . . Regulation of additional air supply only, e.g. using by-passes or variable air pump drives [[3](#)]
  - 3/24 . . . . characterised by constructional aspects of converting apparatus (filtering in combination with catalytic reactors [3/035](#)) [[3,7](#)]
  - 3/26 . . . . Construction of thermal reactors [[3](#)]
  - 3/28 . . . . Construction of catalytic reactors [[3](#)]
  - 3/30 . . . . Arrangements for supply of additional air (regulation, e.g. using by-passes or variable air pump drives, [3/22](#)) [[3](#)]
  - 3/32 . . . . . using air pumps (using jet air pumps [3/34](#); pumps in general [F 04](#)) [[3](#)]
  - 3/34 . . . . . using air conduits or jet air pumps, e.g. near the engine exhaust port [[3](#)]
  - 3/36 . . . . . Arrangements for supply of additional fuel [[3](#)]
  - 3/38 . . . . . Arrangements for igniting [[3](#)]
- 5/00 Exhaust or silencing apparatus combined or associated with devices profiting by exhaust energy** (using kinetic or wave energy of exhaust gases in exhaust systems for charging [F 02 B](#); predominant aspects of such devices, see the relevant classes for the devices)
- 5/02 . the devices using heat
  - 5/04 . the devices using kinetic energy

- 7/00 Exhaust or silencing apparatus, or parts thereof, having pertinent characteristics not provided for in, or of interest apart from, groups 1/00 to 5/00, 9/00, 11/00**
- 7/02 . Apparatus having two or more separate silencers in series
  - 7/04 . Apparatus having two or more silencers in parallel, e.g. having interconnections for multi-cylinder engines
  - 7/06 . specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds
  - 7/08 . Other arrangements or adaptations of exhaust conduits (pipes in general [F 16 L](#))
  - 7/10 . . of exhaust manifolds
  - 7/12 . specially adapted for submerged exhausting
- 7/14 . having thermal insulation
  - 7/16 . Selection of particular materials
  - 7/18 . Construction facilitating manufacture, assembly, or disassembly
  - 7/20 . Flared outlets, e.g. of fish-tail shape
- 9/00 Electrical control of exhaust gas treating apparatus** (monitoring or diagnostic devices for exhaust-gas treatment apparatus [11/00](#); conjoint electrical control of two or more combustion engine functions [F 02 D 43/00](#)) [4]
- 11/00 Monitoring or diagnostic devices for exhaust-gas treatment apparatus** [7]

**F 01 P COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES** (arrangements in connection with cooling of propulsion units in vehicles [B 60 K 11/00](#); heat-transfer, heat-exchange or heat-storage materials [C 09 K 5/00](#); heat-exchange in general, radiators [F 28](#))

**Notes**

- (1) In this subclass, the following terms or expressions are used with the meanings indicated:
- “air” also includes other gaseous cooling fluids;
  - “liquid cooling” also includes cooling where liquid is used as the heat-transferring fluid between parts to be cooled and the air, e.g. using radiators;
  - “air cooling” means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained under liquid cooling above;
  - “cooling-air” includes directly- or indirectly-acting cooling-air.
- (2) Attention is drawn to the Notes preceding class [F 01](#), especially as regards Note (3).
- (3) Cooling by lubricant is classified in subclass [F 01 M](#) when the lubrication aspect predominates, and in subclass [P](#) when the cooling aspect predominates.

**Air cooling; Liquid cooling** (propelling cooling-air or liquid coolants [5/00](#); controlling supply or circulation of coolants [7/00](#); cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

**1/00 Air cooling**

- 1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
- 1/04 . Arrangements for cooling pistons
- 1/06 . Arrangements for cooling other engine or machine parts
- 1/08 . . for cooling intake or exhaust valves
- 1/10 . . for cooling fuel injectors or sparking-plugs

**3/00 Liquid cooling**

- 3/02 . Arrangements for cooling cylinders or cylinder heads
- 3/04 . . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
- 3/06 . Arrangements for cooling pistons
- 3/08 . . Cooling of piston exterior only, e.g. by jets

- 3/10 . . Cooling by flow of coolant through pistons
- 3/12 . Arrangements for cooling other engine or machine parts
- 3/14 . . for cooling intake or exhaust valves
- 3/16 . . for cooling fuel injectors or sparking-plugs
- 3/18 . Arrangement or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads [3/04](#); relative to vehicles [B 60 K 11/04](#))
- 3/20 . Cooling circuits not specific to a single part of engine or machine ([3/22](#) takes precedence)
- 3/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation [9/02](#)); characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point

**Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants**

- 5/00 Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps **7/00**)
- 5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
  - 5/04 . . Pump-driving arrangements
  - 5/06 . . Guiding or ducting air to or from ducted fans
  - 5/08 . . Use of engine exhaust gases for pumping cooling-air
  - 5/10 . Pumping liquid coolant; Arrangements of coolant pumps
  - 5/12 . . Pump-driving arrangements
  - 5/14 . Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pumps
- 7/00 Controlling of coolant flow**
- 7/02 . the coolant being cooling-air
  - 7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
  - 7/06 . . by varying blade pitch
  - 7/08 . . by cutting in or out of pumps
  - 7/10 . . by throttling amount of air flowing through liquid-to-air heat-exchangers
  - 7/12 . . . by thermostatic control
  - 7/14 . the coolant being liquid
  - 7/16 . . by thermostatic control

- 9/00 Cooling having pertinent characteristics not provided for in, or of interest apart from, groups 1/00 to 7/00** (profiting from waste heat of combustion-engine cooling **F 02 G 5/00**)
- 9/02 . Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles **3/22**)
  - 9/04 . by simultaneous or alternative use of direct air cooling and liquid cooling (**9/02** takes precedence)
  - 9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type
- 11/00 Component parts, details, or accessories, not provided for in, or of interest apart from, groups 1/00 to 9/00**
- 11/02 . Liquid-coolant overflow, venting, or draining devices (automatic draining during freezing conditions **11/20**)
  - 11/04 . Arrangements of liquid pipes or hoses
  - 11/06 . Cleaning (in general **B 08 B**); Combating corrosion (in general **C 23 F**)
  - 11/08 . Arrangements of lubricant coolers (in lubrication apparatus **F 01 M**)
  - 11/10 . Guiding or ducting cooling-air to or from liquid-to-air heat-exchangers
  - 11/12 . Filtering, cooling, or silencing cooling-air
  - 11/14 . Indicating devices; Other safety devices
  - 11/16 . . concerning coolant temperature (**11/20** takes precedence)
  - 11/18 . . concerning coolant pressure, coolant flow, or liquid-coolant level
  - 11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather