

# International Patent Classification

2012.01

Section F

MECHANICAL  
ENGINEERING; LIGHTING;  
HEATING; WEAPONS;  
BLASTING



World Intellectual Property Organization

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# SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

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## ENGINES OR PUMPS

### Note(s)

#### Guide to the use of this subsection (classes F01-F04)

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 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".
3. In this subsection:
  - cyclically operating valves, lubricating, gas-flow silencers or exhaust apparatus, or cooling are classified in subclasses F01L, F01M, F01N, F01P 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 F01-F04;
  - lubricating, gas-flow silencers or exhaust apparatus, or cooling of machines or engines are classified in subclasses F01M, F01N, F01P except for those peculiar to steam engines which are classified in subclass F01B.
4. For use of this subsection with a good understanding, it is essential to remember, so far as subclasses F01B, F01C, F01D, F03B, and F04B, F04C, F04D, 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 F02, 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 F01B, F03B, F04B, 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 F03B, in its part dealing with "machines", should be considered as being the general class relating to subclasses F04B, F04C, and in its part dealing with "engines" as being general in relation to subclass F03C.

- ii. Characteristics
  - a. The principal classifying characteristic of the subclass is that of genera of apparatus, of which there are three possible:  
Machines; engines; pumps.
  - b. 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.
  - c. 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.
  - d. 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 subsection index below.

It is seen from this index that:

- For the same kind of apparatus in a given genus, the characteristics of "working fluid" associates:  
F01B and F04B to Machines  
F01C and F04C to Machines  
F01D and F03B to Machines  
F01B and F03C to Engines  
F01C and F03C to Engines  
F01D and F03B to Engines
- For the same kind of working fluid, the "apparatus" characteristic relates subclasses in the same way as considerations of relative generality.

#### Class index

##### MACHINES

positive displacement	
rotary or oscillating piston	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01C
liquid only.....	F04C
reciprocating piston or other	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01B
liquid only.....	F04B
non-positive displacement	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01D
liquid only.....	F03B

##### ENGINES

positive displacement	
rotary or oscillating piston	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01C
liquid only.....	F03C
reciprocating piston or other	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01B
liquid only.....	F03C
non-positive displacement	
liquid <u>and</u> elastic fluid or elastic fluid.....	F01D
liquid only.....	F03B

##### PUMPS

positive displacement	
rotary or oscillating piston.....	F04C
reciprocating piston or other.....	F04B
non-positive displacement.....	F04D

Section F

**F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES**

**F01B MACHINES OR ENGINES, IN GENERAL OR OF POSITIVE-DISPLACEMENT TYPE, e.g. STEAM ENGINES** (of rotary-piston or oscillating-piston type F01C; of non-positive-displacement type F01D; combustion engines F02; internal-combustion aspects of reciprocating-piston engines F02B 57/00, F02B 59/00; machines for liquids F03, F04; crankshafts, crossheads, connecting-rods F16C; flywheels F16F; gears for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, for engines in general F16J)

**Note(s)**

1. This subclass covers, with the exception of the matter provided for in subclasses F01C-F01P:
  - 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 F01, especially as regards the definitions of "steam" and "special vapour".

**Subclass index**

MACHINES OR ENGINES

With reciprocating pistons characterised by

number or relative disposition of cylinders.....	1/00
disposition of cylinder axes relative to main shaft.....	3/00, 5/00
pistons reciprocating in same or coaxial cylinders; piston-main-shaft connections other than covered above.....	7/00, 1/08, 9/00
no rotary main shaft.....	11/00
rotary or other movement of cylinders.....	13/00, 15/00
uniflow principle.....	17/00

With positive displacement of flexible-wall type..... 19/00

COMBINATIONS OR ADAPTATIONS OF MACHINES OR ENGINES..... 21/00, 23/00

REGULATING, CONTROLLING, SAFETY MEANS; STARTING..... 25/00, 27/00

OTHER CHARACTERISTICS; DETAILS, ACCESSORIES..... 29/00, 31/00

<p><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 (F01B 3/00, F01B 5/00 take precedence) [2]</b></p> <p>1/01 • with one single cylinder [2]</p> <p>1/02 • with cylinders all in one line</p> <p>1/04 • with cylinders in V-arrangement</p> <p>1/06 • with cylinders in star or fan arrangement</p> <p>1/08 • with cylinders arranged oppositely relative to main shaft and of "flat" type</p> <p>1/10 • with more than one main shaft, e.g. coupled to common output shaft (combinations of two or more machines or engines F01B 21/00)</p> <p>1/12 • Separate cylinder-crankcase elements coupled together to form a unit</p> <p><b>3/00 Reciprocating-piston machines or engines with cylinder axes coaxial with, or parallel or inclined to, main shaft axis</b></p> <p>3/02 • with wobble-plate</p> <p>3/04 • the piston motion being transmitted by curved surfaces</p> <p>3/06 • • by multi-turn helical surfaces and automatic reversal</p> <p>3/08 • • • the helices being arranged on the pistons</p> <p>3/10 • Control of working-fluid admission or discharge peculiar thereto (suitable for more general application F01L)</p>	<p><b>5/00 Reciprocating-piston machines or engines with cylinder axes arranged substantially tangentially to a circle centred on main shaft axis</b></p> <p><b>7/00 Machines or engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders</b> (in opposite arrangement relative to main shaft F01B 1/08)</p> <p>7/02 • with oppositely reciprocating pistons</p> <p>7/04 • • acting on same main shaft</p> <p>7/06 • • • using only connecting-rods for conversion of reciprocatory into rotary motion or <i>vice versa</i></p> <p>7/08 • • • • with side rods</p> <p>7/10 • • • • having piston-rod of one piston passed through other piston</p> <p>7/12 • • • using rockers and connecting-rods</p> <p>7/14 • • acting on different main shafts</p> <p>7/16 • with pistons synchronously moving in tandem arrangement</p> <p>7/18 • with differential piston (F01B 7/20 takes precedence)</p> <p>7/20 • with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other</p> <p><b>9/00 Reciprocating-piston machines or engines characterised by connections between pistons and main shafts and not specific to groups F01B 1/00-F01B 7/00</b> (connections disengageable during idling F01B 31/24)</p> <p>9/02 • with crankshaft</p> <p>9/04 • with rotary main shaft other than crankshaft</p>
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- 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 F01B 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 (F01B 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 F01B 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 F01B 13/00** (with movable cylinder sleeves for working-fluid control F01L)
- 15/02 • with reciprocating cylinders (with one piston within another F01B 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** (F01B 23/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H; 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** (F01B 11/00 takes precedence; fluid gearing F16H; 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 G05)
- 25/02 • Regulating or controlling by varying working-fluid admission or exhaust, e.g. by varying pressure or quantity (distributing or expansion valve gear F01L)
- 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 F16K)
- 25/12 • • Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone F01B 25/04; final actuators alone F01B 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 F01B 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 F02N)
- 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 F16H)
- 29/00 Machines or engines with pertinent characteristics other than those provided for in main groups F01B 1/00-F01B 27/00**
- 29/02 • Atmospheric engines, i.e. atmosphere acting against vacuum
- 29/04 • characterised by means for converting from one type to a different one
- 29/06 • • from steam engine into combustion engine
- 29/08 • Reciprocating-piston machines or engines not otherwise provided for
- 29/10 • • Engines (refrigeration machines F25B)
- 29/12 • • • Steam engines (toy steam engines A63H 25/00)
- 31/00 Component parts, details, or accessories not provided for in, or of interest apart from, other groups** (machine or engine casings, other than those peculiar to steam engines, F16M)
- 31/02 • De-icing means for engines having icing phenomena
- 31/04 • Means for equalising torque in reciprocating-piston machines or engines (compensation of inertial forces, suppression of vibration in systems F16F)
- 31/06 • Means for compensating relative expansion of component parts
- 31/08 • Cooling of steam engines (cooling of fluid machines or engines in general F01P); Heating; Heat insulation (heat insulation in general F16L 59/00)
- 31/10 • Lubricating arrangements of steam engines (of fluid machines or engines in general F01M)

## F01B

- |       |   |       |  |
|-------|---|-------|--|
| 31/12 | • Arrangements of measuring or indicating devices (warning apparatus F01B 25/26; measuring instruments or the like <u>per se</u> G01)   | 31/24 | • • Disengagement of connections between pistons and main shafts                             |
| 31/14 | • Changing of compression ratio   | 31/26 | • Other component parts, details, or accessories, peculiar to steam engines                  |
| 31/16 | • Silencers specially adapted for steam engines (arrangements of exhaust pipes or tubes on steam engines F01B 31/30; gas-flow silencers or exhaust silencers for machines or engines in general F01N) | 31/28 | • • Cylinders or cylinder covers   |
| 31/18 | • Draining  | 31/30 | • • Arrangements of steam conduits   |
| 31/20 | • • of cylinders  | 31/32 | • • Arrangements or adaptations of vacuum breakers   |
| 31/22 | • Idling devices, e.g. having by-passing valves   | 31/34 | • • Safety means against water hammer or against the penetration of water (steam traps F16T) |
|       |   | 31/36 | • • • automatically cutting-off steam supply   |

## F01C ROTARY-PISTON OR OSCILLATING-PISTON MACHINES OR ENGINES (combustion engines F02; internal-combustion aspects F02B 53/00, F02B 55/00; machines for liquids F03, F04)

### Note(s)

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 F01, 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.....	1/00-7/00
With oscillating pistons.....	9/00
Control; monitoring; safety arrangements.....	20/00
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

- |  |       |  |
|--|-------|--|
| <b>1/00 Rotary-piston machines or engines</b> (with axes of co-operating members non-parallel F01C 3/00; with the working-chamber walls at least partly resiliently deformable F01C 5/00; with fluid ring or the like F01C 7/00; rotary-piston machines or engines in which the working fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F01B 13/00) | 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 (F01C 1/16 takes precedence)  |
|  | 1/20  | • • • • with dissimilar tooth forms (F01C 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 |
| <b>Note(s)</b><br>Group F01C 1/30 takes precedence over groups F01C 1/02-F01C 1/24.  |       |  |
| 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 (F01C 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]   |       |  |

- 1/24 • 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 F01C 1/02, F01C 1/08, F01C 1/22, F01C 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 F01C 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 F01C 1/08 or F01C 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 F01C 1/22 and F01C 1/24
- 1/38 • • having the movement defined in group F01C 1/02 and having a hinged member (F01C 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 F01C 1/08 or F01C 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 F01C 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** (F01C 13/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H)
- 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 (F01C 1/077 takes precedence) [3]
- 17/04 • of cam-and-follower type (F01C 1/067 takes precedence) [3]
- 17/06 • using cranks, universal joints, or similar elements (F01C 1/07 takes precedence) [3]
- 19/00 Sealing arrangements in rotary-piston machines or engines** (sealings in general F16J)
- 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
- 20/00 Control of, monitoring of, or safety arrangements for, machines or engines [2006.01]**
- 20/02 • specially adapted for several machines or engines connected in series or in parallel [2006.01]
- 20/04 • specially adapted for reversible machines or engines [2006.01]
- 20/06 • specially adapted for stopping, starting, idling or no-load operation [2006.01]
- 20/08 • characterised by varying the rotational speed [2006.01]
- 20/10 • characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [2006.01]
- 20/12 • • using sliding valves [2006.01]
- 20/14 • • using rotating valves [2006.01]
- 20/16 • • using lift valves [2006.01]
- 20/18 • characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F01C 20/10) [2006.01]
- 20/20 • • by changing the form of the inner or outer contour of the working chamber [2006.01]
- 20/22 • • by changing the eccentricity between cooperating members [2006.01]
- 20/24 • characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F01C 20/10 takes precedence) [2006.01]
- 20/26 • • using bypass channels [2006.01]
- 20/28 • Safety arrangements; Monitoring [2006.01]
- 21/00 Component parts, details, or accessories, not provided for in groups F01C 1/00-F01C 20/00**

## F01C

- |       |  |       |  |
|-------|--|-------|--|
| 21/02 | • Arrangements of bearings (bearing constructions F16C)  | 21/08 | • Rotary pistons (reciprocating pistons in general F16J)   |
| 21/04 | • Lubrication (of machines or engines in general F01M)   | 21/10 | • Outer members for co-operation with rotary pistons; Casings (casings for rotary engines or machines in general F16M)               |
| 21/06 | • Heating; Cooling (of machines or engines in general F01P); Heat insulation (heat insulation in general F16L) | 21/18 | • Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet <b>[2006.01]</b> |

**F01D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (combustion engines F02; machines or engines for liquids F03, F04; non-positive-displacement pumps F04D)

### Note(s)

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 F01, 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 | <b>Non-positive-displacement machines or engines, e.g. steam turbines</b> (with working-fluid flows in opposite axial directions for balancing axial thrust F01D 3/02; with other than pure rotation F01D 23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor F01K) | 1/24        | • characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like                                |
| 1/02 | • with stationary working-fluid guiding means and bladed or like rotor (F01D 1/24 takes precedence; without working-fluid guiding means F01D 1/18) <b>[5]</b>  | 1/26        | • • traversed by the working-fluid substantially axially  |
| 1/04 | • • traversed by the working-fluid substantially axially   | 1/28        | • • traversed by the working-fluid substantially radially   |
| 1/06 | • • 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 F01D 13/00) |
| 1/08 | • • • having inward flow   | 1/32        | • with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor                        |
| 1/10 | • • having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (F01D 1/12 takes precedence)   | 1/34        | • characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) <b>[5]</b>  |
| 1/12 | • • with repeated action on same blade ring  | 1/36        | • • using fluid friction  |
| 1/14 | • • • traversed by the working-fluid substantially radially  | 1/38        | • • of the screw type <b>[5]</b>  |
| 1/16 | • • characterised by having both reaction stages and impulse stages  | <b>3/00</b> | <b>Machines or engines with axial-thrust balancing effected by working fluid</b>  |
| 1/18 | • without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) <b>[5]</b>   | 3/02        | • characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction  |
| 1/20 | • • traversed by the working-fluid substantially axially   | 3/04        | • axial thrust being compensated by thrust-balancing dummy piston or the like   |
| 1/22 | • • traversed by the working-fluid substantially radially  | <b>5/00</b> | <b>Blades; Blade-carrying members</b> (nozzle boxes F01D 9/02); <b>Heating, heat-insulating, cooling, or antivibration means on the blades or the members</b>   |
|      |  | 5/02        | • Blade-carrying members, e.g. rotors (rotors of non-bladed type F01D 1/34; stators F01D 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 F01D 5/30; rotors with blades adjustable in operation F01D 7/00; stator blades F01D 9/02)
- 5/14 • • Form or construction (selecting particular materials, measures against erosion or corrosion F01D 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 F01D 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 F16J)
- 11/02 • by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator F01D 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 F01D 5/20)
- 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 F01D 7/00) [6]
- 11/16 • • • by self-adjusting means (F01D 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** (F01D 15/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H; regulating or controlling, see the relevant groups)
- 13/02 • Working-fluid interconnection of machines or engines
- 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 F01D 13/00)
- 17/00 Regulating or controlling by varying flow** (for reversing F01D 1/30; by varying rotor blade position F01D 7/00; specially for starting F01D 19/00; shutting-down F01D 21/00; regulating or controlling in general G05)
- 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 F16K)
- 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 F01D 17/02; final actuators alone F01D 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 F01D 25/10; turning or inching gear F01D 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

**F01D**

21/08	• • Restoring position	25/10	• • Heating, e.g. warming-up before starting
21/10	• responsive to unwanted deposits on blades, in working-fluid conduits, or the like	25/12	• • Cooling
21/12	• responsive to temperature	25/14	• • Casings modified therefor (double casings F01D 25/26)
21/14	• responsive to other specific conditions	25/16	• Arrangement of bearings; Supporting or mounting bearings in casings (bearings <u>per se</u> F16C)
21/16	• Trip gear	25/18	• Lubricating arrangements (of machines or engines in general F01M)
21/18	• • involving hydraulic means	25/20	• • using lubrication pumps
21/20	• Checking operation of shut-down devices	25/22	• • using working fluid or other gaseous fluid as lubricant
<b>23/00</b>	<b>Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type</b>	25/24	• Casings (modified for heating or cooling F01D 25/14); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general F16M)
<b>25/00</b>	<b>Component parts, details, or accessories, not provided for in, or of interest apart from, other groups</b>	25/26	• • Double casings; Measures against temperature strain in casings
25/02	• De-icing means for engines having icing phenomena	25/28	• Supporting or mounting arrangements, e.g. for turbine casing
25/04	• Antivibration arrangements	25/30	• Exhaust heads, chambers, or the like
25/06	• • for preventing blade vibration (means on blade-carrying members or blades F01D 5/00)	25/32	• Collecting of condensation water; Drainage
25/08	• Cooling (of machines or engines in general F01P); Heating; Heat insulation (of blade-carrying members, of blades F01D 5/00)	25/34	• Turning or inching gear
		25/36	• • using electric motors

**F01K STEAM ENGINE PLANTS; STEAM ACCUMULATORS; ENGINE PLANTS NOT OTHERWISE PROVIDED FOR; ENGINES USING SPECIAL WORKING FLUIDS OR CYCLES (gas-turbine or jet-propulsion plants F02; steam generation F22; nuclear power plants, engine arrangements therein G21D)**

Note(s)

Attention is drawn to the Notes preceding class F01, 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

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<b>1/00</b>	<b>Steam accumulators</b> (use of accumulators in steam engine plants F01K 3/00)	1/10	• specially adapted for superheated steam
1/02	• for storing steam otherwise than in a liquid	1/12	• Multiple accumulators; Charging, discharging, or regulating peculiar thereto
1/04	• for storing steam in a liquid, e.g. Ruth type (in alkali to increase steam pressure F22B 1/20)	1/14	• • Circulation
1/06	• • Internal fittings facilitating steam distribution, steam formation, or circulation (acting during charging or discharging F01K 1/08; fittings facilitating circulation through multiple accumulators F01K 1/14)	1/16	• Other safety or regulating means
		1/18	• • for steam pressure
		1/20	• Other steam-accumulator parts, details, or accessories
1/08	• Charging or discharging of accumulators with steam (peculiar to multiple accumulators F01K 1/12)		

**Steam engine plants**

- 3/00 Plants characterised by the use of steam or heat accumulators, or intermediate steam heaters, therein** (regenerating exhaust steam F01K 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 F22G)
- 3/16 • • Mutual arrangement of accumulator and heater
- 3/18 • having heaters (having both steam accumulator and heater F01K 3/14; steam heaters per se F22)
- 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 Koemann type**
- 5/02 • used in regenerative installation
- 7/00 Steam engine plants characterised by the use of specific types of engine** (F01K 3/02 takes precedence); **Plants or engines characterised by their use of special steam systems, cycles, or processes** (reciprocating-piston engines using uniflow principle F01B 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 F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34)
- 7/04 • • Regulating means peculiar thereto
- 7/06 • the engines being of multiple-inlet-pressure type (F01K 7/02 takes precedence; the engines being only of turbine type F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 7/34)
- 7/08 • • Regulating means peculiar thereto
- 7/10 • characterised by the engine exhaust pressure (the engines being only of turbine type F01K 7/16; the engines using steam of critical or over-critical pressure F01K 7/32; the engines being of extraction or non-condensing type F01K 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 F01K 7/32; the engines being of extraction or non-condensing type F01K 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 F22D)
- 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 Steam engine plants characterised by condensers arranged or modified to co-operate with the engines** (by condensers structurally combined with engines F01K 11/00; steam condensers per se F28B)
- 9/02 • Arrangements or modifications of condensate or air pumps
- 9/04 • with dump valves to by-pass stages
- 11/00 Steam engine 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 steam engine plants**
- 13/02 • Regulating, e.g. stopping or starting
- 15/00 Adaptations of steam engine 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 F01K 7/34; returning condensate to boiler F22D)
- 17/02 • for heating purposes, e.g. industrial, domestic (F01K 17/06 takes precedence; domestic- or space-heating systems, e.g. central-heating systems, in general F24D 1/00, F24D 3/00, F24D 9/00) [3]
- 17/04 • for specific purposes other than heating (F01K 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 F01K 5/00; returning condensate to boiler F22D)
- 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

## F01K

- 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 F22B)
- 21/06 • Treating live steam, other than thermodynamically, e.g. for fighting deposits in engine

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### 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 (F01K 23/02 takes precedence)

- 23/14 • • including at least one combustion engine
- 23/16 • • all the engines being turbines (F01K 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 F01K 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

## F01L CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES (valves in general F16K)

### Note(s)

1. Groups F01L 1/00-F01L 13/00 cover only valve-gear or valve arrangements without provision for variable fluid distribution.
2. Valve gear or valve arrangements specially adapted for steam engines are covered by groups F01L 15/00-F01L 35/00.
3. Valve-gear or valve arrangements specially adapted for machines or engines with variable working-fluid distribution are covered by groups F01L 15/00-F01L 35/00.
4. Attention is drawn to the Notes preceding class F01, especially Note (3).
5. As regards the above-mentioned Note (3), attention is drawn to F01B 3/10, F01B 15/06, F01C 20/20, F01C 21/18, F02B 53/06, F03C 1/08, F04B 1/18, F04B 7/00, F04B 39/08, F04B 39/10, F04C 14/00, F04C 15/06, F04C 28/00 and F04C 29/12.

### 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.....	21/00-27/00, 29/00
Other valve-gear or valve arrangements.....	15/00
Drive, control, or adjustment.....	25/00, 31/00

**Valve-gear or valve arrangements for positive-displacement machines or engines other than steam engines, e.g. for internal-combustion piston engines, without provision for variable fluid distribution**

- 1/00** Valve-gear or valve arrangements, e.g. lift-valve gear (lift valve and valve seat assemblies *per se* F01L 3/00; slide-valve gear F01L 5/00; actuated non-mechanically F01L 9/00; valve arrangements in working piston or piston-rod F01L 11/00; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations F01L 13/00)
- 1/02 • Valve drive (transmitting-gear between valve drive and valve F01L 1/12)
- 1/04 • • by means of cams, camshafts, cam discs, eccentrics, or the like (F01L 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 F01L 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 F01L 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 (F01L 1/26, F01L 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 F02B)
- 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 F01L 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 F01L 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 F01L 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 F01L 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 F01L 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 reciprocating valve and other slide valve
- 5/20 • specially for two-stroke engines (F01L 5/06, F01L 5/14 take precedence)
- 5/22 • Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 5/06; with reciprocating and other slide valves F01L 5/18; specially for two-stroke engines F01L 5/20)
- 5/24 • Component parts, details, or accessories, not provided for in preceding subgroups of this group

7/00	<b>Rotary or oscillatory slide-valve gear or valve arrangements</b> (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves F01L 5/00)	15/06	• • • of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself
7/02	• with cylindrical, sleeve, or part-annularly-shaped valves (of disc type F01L 7/06; of conical type F01L 7/08)	15/08	• with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves
7/04	• • surrounding working cylinder or piston	15/10	• with main slide valve and auxiliary valve dragged thereby
7/06	• with disc-type valves	15/12	• characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling
7/08	• with conically- or frusto-conically-shaped valves	15/14	• Arrangements with several co-operating main valves, e.g. reciprocatory and rotary
7/10	• with valves of other specific shape, e.g. spherical	15/16	• • with reciprocatory slide valves only
7/12	• specially for two-stroke engines (F01L 7/04 takes precedence)	15/18	• Valve arrangements not provided for in preceding subgroups of this group
7/14	• Multiple-valve arrangements (with valves surrounding working cylinder or piston F01L 7/04; specially for two-stroke engines F01L 7/12)	15/20	• Component parts, details, or accessories, not provided for in preceding subgroups of this group
7/16	• Sealing or packing arrangements specially therefor	<b>17/00</b>	<b>Slide-valve gear or valve arrangements with cylindrical, sleeve, or part-annularly-shaped valves surrounding working cylinder or piston</b>
7/18	• Component parts, details, or accessories, not provided for in preceding subgroups of this group	17/02	• Drive, or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other
<b>9/00</b>	<b>Valve-gear or valve arrangements actuated non-mechanically</b>	<b>19/00</b>	<b>Slide-valve gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in group F01L 17/00, e.g. longitudinally and in cross direction of working cylinder</b>
9/02	• by fluid means, e.g. hydraulic	19/02	• Drive, or adjustment during operation, peculiar thereto
9/04	• by electric means	<b>21/00</b>	<b>Use of working pistons or piston-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines</b>
<b>11/00</b>	<b>Valve arrangements in working piston or piston-rod</b>	21/02	• Piston or piston-rod used as valve member
11/02	• in piston	21/04	• Valves arranged in or on piston or piston-rod
11/04	• • operated by movement of connecting-rod	<b>23/00</b>	<b>Valves controlled by impact of piston, e.g. in free-piston machines</b>
11/06	• • • operating oscillatory valve	<b>25/00</b>	<b>Drive, or adjustment during operation, of distribution or expansion valves by non-mechanical means</b>
<b>13/00</b>	<b>Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations</b>	25/02	• by fluid means
13/02	• for reversing	25/04	• • by working fluid of machine or engine, e.g. free-piston machine
13/04	• for starting by means of fluid pressure	25/06	• • • Arrangements with main and auxiliary valves, at least one of them being fluid-driven
13/06	• for braking	25/08	• by electric or magnetic means
13/08	• for decompression, e.g. during starting; for changing compression ratio	<b>27/00</b>	<b>Distribution or expansion-valve gear peculiar to free-piston machines or engines and not provided for in groups F01L 21/00-F01L 25/00</b>
<b><u>Valve-gear or valve arrangements specially adapted for steam engines, or specially adapted for other positive-displacement machines or engines with variable working-fluid distribution</u></b>		27/02	• the machine or engine having rotary or oscillatory valves
<b><u>Note(s)</u></b>		27/04	• Delayed-action controls, e.g. of cataract- or dash-pot-type
1.	Groups F01L 15/00-F01L 31/00cover:	<b>29/00</b>	<b>Reversing-gear</b> (equally usable for control of degree of working fluid admission, and reversing being of secondary importance F01L 31/00)
	• valve drive or means external to valves for adjustment during operation;	29/02	• by displacing eccentric
	• tripping-gear;	29/04	• by links or guide rods
	• reversing-gear;	29/06	• by interchanging inlet and exhaust ports
	• use of pistons or piston-rods as valves or as valve-supporting elements;	29/08	• specially for rotary or oscillatory valves
	• valve-gear or valve arrangements peculiar to free-piston machines or engines.	29/10	• Details, e.g. drive
2.	Groups F01L 15/00-F01L 31/00do not fully cover subject matter restricted to rotary, oscillatory, or lift-valve gear or valve arrangements, which is covered by group F01L 33/00 or F01L 35/00.	29/12	• • Powered reverse gear
<b>15/00</b>	<b>Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups F01L 17/00-F01L 29/00</b> (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. F01L 31/00; tripping-gear or tripping of valves F01L 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 F01L 15/10)		

<p><b>31/00 Valve drive, valve adjustment during operation, or other valve control, not provided for in groups F01L 15/00-F01L 29/00</b> (sensing elements measuring the variable or condition to be controlled or regulated F01B)</p> <p>31/02 • with tripping-gear (for oscillatory valves F01L 31/06); Tripping of valves</p> <p>31/04 • • with positively-driven trip levers</p> <p>31/06 • with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type</p> <p>31/08 • Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear</p> <p>31/10 • • the drive being effected by eccentrics (F01L 31/14 takes precedence)</p> <p>31/12 • • • Valve adjustment by displacing eccentric</p> <p>31/14 • • Valve adjustment by links or guide rods, e.g. in valve-gears with eccentric drive</p> <p>31/16 • • the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives</p> <p>31/18 • • specially for rotary or oscillatory valves</p> <p>31/20 • • • Valve adjustment</p> <p>31/22 • • specially for lift valves</p> <p>31/24 • • • Valve adjustment</p>	<p><b>Rotary or oscillatory slide-valve gear or lift-valve gear or such valve arrangements specially adapted for steam engines, or specially adapted for other positive-displacement machines or engines with variable working-fluid distribution</b></p> <p><b>33/00 Rotary or oscillatory slide-valve gear or valve arrangements, specially adapted for machines or engines with variable fluid distribution</b> (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 F01L 15/00-F01L 31/00)</p> <p>33/02 • rotary</p> <p>33/04 • oscillatory</p> <p><b>35/00 Lift-valve gear or valve arrangements specially adapted for machines or engines with variable fluid distribution</b> (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 F01L 15/00-F01L 31/00)</p> <p>35/02 • Valves</p> <p>35/04 • Arrangements of valves in the machine or engine, e.g. relative to working cylinder</p>
<p><b>F01M LUBRICATING OF MACHINES OR ENGINES IN GENERAL; LUBRICATING INTERNAL-COMBUSTION ENGINES; CRANKCASE VENTILATING [2]</b></p>	

#### Note(s)

1. Attention is drawn to the Notes preceding class F01, especially as regards Note (3).
2. Attention is drawn to the following places, which cover lubrication of specific machines or engines:
  - F01B 31/10.....Steam engines
  - F01C 21/04.....Rotary-piston or oscillating-piston machines or engines
  - F01D 25/18.....Non-positive-displacement machines
  - F02C 7/06.....Gas-turbine plants
  - F02F 1/20.....Cylinders of combustion engines
  - F04B 39/02.....Pumps for elastic fluids
  - F04C 29/02.....Rotary-piston or oscillating-piston pumps for liquids
  - F04D 29/04.....Non-positive-displacement pumps

#### 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

<p><b>1/00 Pressure lubrication</b></p> <p>1/02 • using lubricating pumps</p> <p>1/04 • using pressure in working cylinder or crankcase to operate lubricant-feeding devices</p> <p>1/06 • Lubricating systems characterised by the provision therein of crankshafts or connecting-rods with lubricant passageways, e.g. bores</p> <p>1/08 • Lubricating systems characterised by the provision therein of lubricant-jetting means</p> <p>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 F01M 11/03)</p>	<p>1/12 • Closed-circuit lubricating systems not provided for in groups F01M 1/02-F01M 1/10</p> <p>1/14 • Timed lubrication (F01M 1/08 takes precedence)</p> <p>1/16 • Controlling lubricant pressure or quantity</p> <p>1/18 • Indicating or safety devices (concerning lubricant level F01M 11/06, F01M 11/12)</p> <p>1/20 • • concerning lubricant pressure</p> <p>1/22 • • • rendering machines or engines inoperative or idling on pressure failure</p> <p>1/24 • • • acting on engine fuel system</p> <p>1/26 • • • acting on engine ignition system</p> <p>1/28 • • • acting on engine combustion-air supply</p>
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## F01M

- 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 F01M 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 F01P 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 F01M 1/00-F01M 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 F01M 1/00-F01M 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 [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
- 11/10 • Indicating devices; Other safety devices
- 11/12 • • concerning lubricant level
- 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]

**F01N 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 B60K 13/00; combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines F02M 35/00; protecting against, or damping, noise in general G10K 11/16)

## Note(s)

Attention is drawn to the Notes preceding class F01, 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 (F01N 1/10 takes precedence; cyclones B04C)
- 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 F01N 1/22)
- 1/22 • • the parts being resilient walls
- 1/24 • by using sound-absorbing materials (F01N 1/04, F01N 1/06, F01N 1/10, F01N 1/14, F01N 1/16 take precedence)
- 3/00 Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust** (electric control F01N 9/00; monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 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 F01N 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 F01N 1/14; arrangements for the supply of additional air for the thermal or catalytic conversion of noxious components of exhaust F01N 3/30) [7]
- 3/06 • for extinguishing sparks
- 3/08 • for rendering innocuous (using electric or electrostatic separators F01N 3/01; chemical aspects B01D 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 (F01N 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 F01N 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, F01N 3/22) [3]
- 3/32 • • • • • using air pumps (using jet air pumps F01N 3/34; pumps in general F04) [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 F02B; 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
- 9/00 **Electrical control of exhaust gas treating apparatus** (monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00; conjoint electrical control of two or more combustion engine functions F02D 43/00) [4]
- 11/00 **Monitoring or diagnostic devices for exhaust-gas treatment apparatus** [7]
- 13/00 **Exhaust or silencing apparatus characterised by constructional features** [2010.01]
- 13/02 • having two or more separate silencers in series [2010.01]
- 13/04 • having two or more silencers in parallel, e.g. having interconnections for multi-cylinder engines [2010.01]
- 13/06 • specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds [2010.01]
- 13/08 • Other arrangements or adaptations of exhaust conduits [2010.01]
- 13/10 • • of exhaust manifolds [2010.01]
- 13/12 • specially adapted for submerged exhausting [2010.01]
- 13/14 • having thermal insulation [2010.01]
- 13/16 • Selection of particular materials [2010.01]
- 13/18 • Construction facilitating manufacture, assembly or disassembly [2010.01]
- 13/20 • having flared outlets, e.g. of fish-tail shape [2010.01]
- 99/00 **Subject matter not provided for in other groups of this subclass** [2010.01]

**F01P COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES** (arrangements in connection with cooling of propulsion units in vehicles B60K 11/00; heat-transfer, heat-exchange or heat-storage materials C09K 5/00; heat-exchange in general, radiators F28)

#### Note(s)

- 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.
- Attention is drawn to the Notes preceding class F01, especially as regards Note (3).
- Cooling by lubricant is classified in subclass F01M when the lubrication aspect predominates, and in subclass F01P when the cooling aspect predominates.

#### **Air cooling; Liquid cooling**

- 1/00 **Air cooling** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00)
- 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** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00)
- 3/02 • Arrangements for cooling cylinders or cylinder heads

## F01P

- 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 F01P 3/04; relative to vehicles B60K 11/04)
- 3/20 • Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)
- 3/22 • characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation F01P 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 F01P 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

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### 9/00 **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00-F01P 7/00** (profiting from waste heat of combustion-engine cooling F02G 5/00)

- 9/02 • Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles F01P 3/22)
- 9/04 • by simultaneous or alternative use of direct air cooling and liquid cooling (F01P 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 F01P 1/00-F01P 9/00**

- 11/02 • Liquid-coolant overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
- 11/04 • Arrangements of liquid pipes or hoses
- 11/06 • Cleaning (in general B08B); Combating corrosion (in general C23F)
- 11/08 • Arrangements of lubricant coolers (in lubrication apparatus F01M)
- 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 (F01P 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

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

**F02B INTERNAL-COMBUSTION PISTON ENGINES; COMBUSTION ENGINES IN GENERAL** (cyclically operating valves therefor F01L; lubricating internal-combustion engines F01M; gas-flow silencers or exhaust apparatus therefor F01N; cooling of internal-combustion engines F01P; internal-combustion turbines F02C; plants in which engines use combustion products F02C, F02G)

### Note(s)

1. In this subclass, the following terms or expression are used with the meanings indicated:
  - "positive ignition" means ignition by a source external to the working fluid, e.g. by spark or incandescent source;
  - "charging" means forcing air or fuel-air mixture into engine cylinders, and thus includes supercharging;
  - "scavenging" means forcing the combustion residues from the cylinders other than by movement of the working pistons, and thus includes tuned exhaust systems.
2. Attention is drawn to the Notes preceding class F01, especially as regards Note (1).
3. Engines with specified cycles or number of cylinders are classified in group F02B 75/02 or F02B 75/16, unless other classifying features predominate.

**Subclass index**

## ENGINES USING FLUID FUEL

Characterised by fluid to be compressed or by ignition.....1/00-11/00

Characterised by the combustion, inlet or charging, or evacuation

combustion

chambers for: precombustion; air storage; combustion.....19/00, 21/00, 23/00

charge: stratification; rotation.....17/00, 31/00

introduction of fuel.....13/00, 15/00, 49/00

inlet or charging, or scavenging

general characteristics; details.....25/00-29/00, 29/00

pumps; details.....33/00-37/00, 39/00

Special means for improving efficiency.....41/00

## ENGINES USING NON-LIQUID FUEL, THEIR COMBINATIONS WITH FUEL-GENERATING

APPARATUS.....43/00, 45/00

## OPERATION CHARACTERISED BY TREATMENT OR PRETREATMENT OF FUEL, AIR, OR

MIXTURE.....7/00, 47/00, 49/00, 51/00

## SPECIAL FORMS OR APPLICATIONS

Kinds of engine

kinds of piston: rotary, oscillating; reciprocating in rotary engines or movable cylinders; free-piston

or without rotating main shaft.....53/00, 55/00, 57/00, 59/00, 71/00

convertible or with interchangeable parts.....69/00

with special auxiliary apparatus.....67/00

other kinds; component parts, details, or accessories.....75/00, 77/00

Combinations, not otherwise provided for, of two or more engines.....73/00

Engines for particular use, combinations with other devices.....61/00-67/00

RUNNING-IN.....79/00

**Engines characterised by the working fluid to be compressed or characterised by the type of ignition****1/00 Engines characterised by fuel-air mixture****compression** (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

1/02 • with positive ignition (with non-timed positive ignition F02B 9/06)

1/04 • • with fuel-air mixture admission into cylinder

1/06 • • • Methods of operating

1/08 • • with separate admission of air and fuel into cylinder

1/10 • • • Methods of operating

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

1/14 • • Methods of operating

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

3/02 • with positive ignition (with non-timed positive ignition F02B 9/06)

3/04 • • Methods of operating

- 3/06 • with compression ignition (F02B 13/02 takes precedence; with fuel-air charge ignited by compression ignition of an additional fuel F02B 7/00)
- 3/08 • • Methods of operating (F02B 3/12 takes precedence)
- 3/10 • • with intermittent fuel introduction
- 3/12 • • • Methods of operating

- 5/00 Engines characterised by positive ignition** (F02B 1/02, F02B 3/02 take precedence; with non-timed positive ignition F02B 9/06; characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)
- 5/02 • Methods of operating

- 7/00 Engines characterised by the fuel-air charge being ignited by compression ignition of an additional fuel** (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)
- 7/02 • the fuel in the charge being liquid
- 7/04 • • Methods of operating
- 7/06 • the fuel in the charge being gaseous
- 7/08 • • Methods of operating

**9/00 Engines characterised by other types of ignition** (characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition F02B 11/00; characterised by precombustion chambers F02B 19/00; characterised by air-storage chambers F02B 21/00; characterised by special shape or construction of combustion chambers F02B 23/00)

- 9/02 • with compression ignition (F02B 1/12, F02B 3/06 take precedence)
- 9/04 • • Methods of operating
- 9/06 • with non-timed positive ignition, e.g. with hot-spots
- 9/08 • • with incandescent chambers
- 9/10 • • • Chamber shapes or constructions

**11/00 Engines characterised by both fuel-air mixture compression and air compression, or characterised by both positive ignition and compression ignition, e.g. in different cylinders** (characterised by 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)

- 11/02 • convertible from fuel-air mixture compression to air compression or vice versa

#### Engines characterised by the method of introducing liquid fuel into cylinders

**13/00 Engines characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid**

- 13/02 • Compression ignition engines using air or gas for blowing fuel into compressed air in cylinder
- 13/04 • • Arrangements or adaptations of pumps
- 13/06 • Engines having secondary air mixed with fuel in pump, compressed therein without ignition, and fuel-air mixture being injected into air in cylinder
- 13/08 • • Arrangements or adaptations of pumps
- 13/10 • Use of specific auxiliary fluids, e.g. steam, combustion gas

**15/00 Engines characterised by the method of introducing liquid fuel into cylinders and not otherwise provided for**

- 15/02 • having means for sucking fuel directly into cylinder

**17/00 Engines characterised by means for effecting stratification of charge in cylinders**

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

**19/00 Engines characterised by precombustion chambers** (engines with incandescent chambers F02B 9/08)

- 19/02 • the chamber being periodically isolated from its cylinder
- 19/04 • • the isolation being effected by a protuberance on piston or cylinder head
- 19/06 • with auxiliary piston in chamber for transferring ignited charge to cylinder space
- 19/08 • the chamber being of air-swirl type
- 19/10 • with fuel introduced partly into pre-combustion chamber, and partly into cylinder (F02B 19/02-F02B 19/08 take precedence)

- 19/12 • with positive ignition (F02B 19/02-F02B 19/10 take precedence)

- 19/14 • with compression ignition (F02B 19/02-F02B 19/10 take precedence)

- 19/16 • Chamber shapes or constructions not specific to groups F02B 19/02-F02B 19/10

- 19/18 • • Transfer passages between chamber and cylinder

**21/00 Engines characterised by air-storage chambers**

- 21/02 • Chamber shapes or constructions

**23/00 Other engines characterised by special shape or construction of combustion chambers to improve operation** (engines with incandescent chambers F02B 9/08)

- 23/02 • with compression ignition

- 23/04 • • the combustion space being subdivided into two or more chambers (with pre-combustion chambers F02B 19/00)

- 23/06 • • the combustion space being arranged in working piston (F02B 23/04 takes precedence)

- 23/08 • with positive ignition

- 23/10 • • with separate admission of air and fuel into cylinder

#### Engines characterised by provision for charging or scavenging

**25/00 Engines characterised by using fresh charge for scavenging cylinders** (aspects characterised by provision of driven charging or scavenging pumps F02B 33/00-F02B 39/00)

- 25/02 • using unidirectional scavenging

- 25/04 • • Engines having ports both in cylinder head and in cylinder wall near bottom of piston stroke

- 25/06 • • • the cylinder-head ports being controlled by working pistons, e.g. by sleeve-shaped extensions thereof

- 25/08 • • Engines with oppositely-moving reciprocating working pistons

- 25/10 • • • with one piston having a smaller diameter or shorter stroke than the other

- 25/12 • • Engines with U-shaped cylinders, having ports in each arm

- 25/14 • using reverse-flow scavenging, e.g. with both inlet and outlet ports arranged near bottom of piston stroke

- 25/16 • • the charge flowing upward essentially along cylinder wall opposite the inlet ports

- 25/18 • • the charge flowing upward essentially along cylinder wall adjacent the inlet ports, e.g. by means of deflection rib on piston

- 25/20 • Means for reducing the mixing of charge and combustion residues or for preventing escape of fresh charge through outlet ports, not provided for in, or of interest apart from, groups F02B 25/02-F02B 25/18

- 25/22 • • by forming air cushion between charge and combustion residues

- 25/24 • • Inlet or outlet openings being timed asymmetrically relative to bottom dead-centre

- 25/26 • Multi-cylinder engines other than those provided for in, or of interest apart from, groups F02B 25/02-F02B 25/24 (internal-combustion aspects of rotary engines with movable cylinders F02B 57/00)

- 25/28 • • with V-, fan-, or star-arrangement of cylinders

27/00	<b>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</b> (aspects characterised by provision of driven charging or scavenging pumps F02B 33/00-F02B 39/00, e.g. use of driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge F02B 33/42)	33/10	• • • with the pumping cylinder situated between working cylinder and crankcase, or with the pumping cylinder surrounding working cylinder
27/02	• the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means (in exhaust systems only F02B 27/06)	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
27/04	• in exhaust systems only, e.g. for sucking-off combustion gases	33/14	• • • • working and pumping pistons forming stepped piston
27/06	• • the systems having variable, i.e. adjustable, cross-sectional areas, chambers of variable volume, or like variable means	33/16	• • • • working and pumping pistons having differing movements
29/00	<b>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</b>	33/18	• • • with crankshaft being arranged between working and pumping cylinders
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; structural features of induction systems F02M)	33/20	• • • with pumping-cylinder axis arranged at an angle to working-cylinder axis, e.g. at an angle of 90°
29/04	• Cooling of air intake supply	33/22	• • • with pumping cylinder situated at side of working cylinder, e.g. the cylinders being parallel
29/06	• After-charging, i.e. supplementary charging after scavenging	33/24	• • with crankcase pumps other than with reciprocating pistons only
29/08	• Modifying distribution valve timing for charging purposes (F02B 29/06 takes precedence; valve-gear therefor F01L)	33/26	• • Four-stroke engines characterised by having crankcase pumps
31/00	<b>Modifying induction systems for imparting a rotation to the charge in the cylinder</b> (structural features of induction systems F02M)	33/28	• • Component parts, details, or accessories of crankcase pumps not provided for in, or of interest apart from, groups F02B 33/02-F02B 33/26
31/02	• in engines having inlet valves arranged eccentrically to cylinder axis (F02B 31/08 takes precedence) [6]	33/30	• • • Control of inlet or outlet ports (controlling only working-cylinder inlets F01L)
31/04	• by means within the induction channel, e.g. deflectors [6]	33/32	• Engines with pumps other than of reciprocating-piston type (with crankcase pumps F02B 33/02)
31/06	• • Movable means, e.g. butterfly valves [6]	33/34	• • with rotary pumps (with cell-type pressure exchangers or the like F02B 33/42)
31/08	• having multiple air inlets [6]	33/36	• • • of positive-displacement type
		33/38	• • • • of Roots type
		33/40	• • • of non-positive-displacement type
		33/42	• • with driven apparatus for immediate conversion of combustion gas pressure into pressure of fresh charge, e.g. with cell-type pressure exchangers (pressure exchangers <i>per se</i> F04F 13/00)
		33/44	• Passages conducting the charge from the pump to the engine inlet, e.g. reservoirs (cooling of charge after leaving pump F02B 29/04)
<b><u>Engines characterised by provision of driven charging or scavenging pumps</u></b>		35/00	<b>Engines characterised by provision of pumps for sucking combustion residues from cylinders</b>
33/00	<b>Engines characterised by provision of pumps for charging or scavenging</b> (characterised by the introduction of liquid fuel into cylinders by use of auxiliary fluid F02B 13/00; characterised by after-charging F02B 29/06; characterised by provision of pumps for sucking combustion residues from cylinders F02B 35/00; characterised by provision of exhaust-driven pumps F02B 37/00)	35/02	• using rotary pumps
33/02	• Engines with reciprocating-piston pumps; Engines with crankcase pumps	37/00	<b>Engines characterised by provision of pumps driven at least for part of the time by exhaust</b> (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)
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	37/007	• with exhaust-driven pumps arranged in parallel [6]
33/06	• • with reciprocating-piston pumps other than simple crankcase pumps	37/013	• with exhaust-driven pumps arranged in series [6]
33/08	• • • with the working-cylinder head arranged between working and pumping cylinders	37/02	• Gas passages between engine outlet and pump drive, e.g. reservoirs
		37/04	• Engines with exhaust drive and other drive of pumps, e.g. with exhaust-driven pump and mechanically-driven second pump
		37/10	• • at least one pump being alternately driven by exhaust and other drive [3]
		37/11	• • • driven by other drive at starting only [6]
		37/12	• Control of the pumps [3]

## F02B

- 37/14 • • of the alternation between exhaust drive and other drive of a pump, e.g. dependent on speed [3]
- 37/16 • • by bypassing charging air [6]
- 37/18 • • by bypassing exhaust [6]
- 37/20 • • by increasing exhaust energy, e.g. using combustion chambers [6]
- 37/22 • • by varying the cross-section of exhaust passages or air passages [6]
- 37/24 • • by using pumps or turbines with adjustable guide vanes [6]

### 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

- 39/02 • Drives of pumps (exhaust drives or combined exhaust and other drives F02B 37/00); Varying pump drive gear ratio (control acting both on engine and on pump drive gear ratio F02D)
- 39/04 • • Mechanical drives; Variable-gear-ratio drives (non-mechanical pump drives having variable gear ratio F02B 39/08)
- 39/06 • • • the engine torque being divided by a differential gear for driving a pump and the engine output shaft
- 39/08 • • Non-mechanical drives, e.g. fluid drives having variable gear ratio
- 39/10 • • • electric
- 39/12 • • Drives characterised by use of couplings or clutches therein (using fluid slip couplings for varying gear ratio F02B 39/08)
- 39/14 • Lubrication of pumps; Safety measures therefor
- 39/16 • Other safety measures for, or other control of, pumps

### 41/00 Engines characterised by special means for improving conversion of heat or pressure energy into mechanical power

- 41/02 • Engines with prolonged expansion
- 41/04 • • in main cylinders
- 41/06 • • in compound cylinders
- 41/08 • • • Two-stroke compound engines
- 41/10 • • using exhaust turbines (use of exhaust turbines for charging F02B 37/00; turbine constructions F01D; gas-turbine plants F02C)

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

- 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)
- 43/02 • Engines characterised by means for increasing operating efficiency
- 43/04 • • for improving efficiency of combustion
- 43/06 • • for enlarging charge
- 43/08 • Plants characterised by the engines using gaseous fuel generated in the plant from solid fuel, e.g. wood
- 43/10 • Engines or plants characterised by use of other specific gases, e.g. acetylene, oxyhydrogen
- 43/12 • • Methods of operating

### 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)

- 45/02 • operating on powdered fuel, e.g. powdered coal (operating on fuel containing oxidant F02B 45/06)
- 45/04 • • Plants, e.g. having coal-grinding apparatus
- 45/06 • operating on fuel containing oxidant
- 45/08 • operating on other solid fuels
- 45/10 • operating on mixtures of liquid and non-liquid fuels, e.g. in pasty or foamed state

### 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

### 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

- 47/02 • the substances being water or steam
- 47/04 • the substances being other than water or steam only
- 47/06 • • the substances including non-airborne oxygen (F02B 47/10 takes precedence)
- 47/08 • • the substances including exhaust gas
- 47/10 • • • Circulation of exhaust gas in closed or semi-closed circuits, e.g. with simultaneous addition of oxygen

### 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

### 51/00 Other methods of operating engines involving pre-treating of, or adding substances to, combustion air, fuel, or fuel-air mixture of the engines

- 51/02 • involving catalysts
- 51/04 • involving electricity or magnetism
- 51/06 • involving rays or sound waves

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

### 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)

- 53/02 • Methods of operating
- 53/04 • Charge admission or combustion-gas discharge
- 53/06 • • Valve control therefor
- 53/08 • • Charging, e.g. by means of rotary-piston pump
- 53/10 • Fuel supply; Introducing fuel to combustion space
- 53/12 • Ignition
- 53/14 • Adaptations of engines for driving, or engine combinations with, other devices (aspects predominantly concerning such devices, see the relevant classes for the devices)

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

- 55/02 • Pistons
- 55/04 • • Cooling thereof
- 55/06 • • • by air or other gas
- 55/08 • Outer members for co-operation with rotary pistons; Casings

- 55/10 • • Cooling thereof
- 55/12 • • • by air or other gas
- 55/14 • Shapes or constructions of combustion chambers
- 55/16 • Admission or exhaust passages in pistons or outer members

**Internal-combustion aspects of reciprocating-piston engines with movable cylinders**

- 57/00 Internal-combustion aspects of rotary engines in which the combusted gases displace one or more reciprocating pistons**
- 57/02 • Fuel or combustion-air supply (cylinder-charge admission or exhaust control F02B 57/04)
  - 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)
  - 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)
  - 57/08 • Engines with star-shaped cylinder arrangements
  - 57/10 • • with combustion space in centre of star
- 59/00 Internal-combustion aspects of other reciprocating-piston engines with movable, e.g. oscillating, cylinders (with yieldable walls F02B 75/38)**

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

- 61/00 Adaptations of engines for driving vehicles or for driving propellers; Combinations of engines with gearing (the engine torque being divided by a differential gear for driving a scavenging or charging pump and the engine output shaft F02B 39/06; adaptations or combinations of rotary-piston or oscillating-piston engines F02B 53/14; arrangements in vehicles, see the relevant classes for vehicles)**
- 61/02 • for driving cycles
  - 61/04 • for driving propellers
  - 61/06 • Combinations of engines with mechanical gearing (F02B 61/02, F02B 61/04 take precedence)
- 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)**
- 63/02 • for hand-held tools
  - 63/04 • for electric generators
  - 63/06 • for pumps
- 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)**

**Engines with pertinent characteristics other than those provided for in, or of interest apart from, preceding main groups**

- 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**
- 67/04 • of mechanically-driven auxiliary apparatus
  - 67/06 • • driven by means of chains, belts, or like endless members
  - 67/08 • of non-mechanically driven auxiliary apparatus
  - 67/10 • of charging or scavenging apparatus [5]
- 69/00 Internal-combustion engines convertible into other combustion-engine type, not provided for in group F02B 11/00; Internal-combustion engines of different types characterised by constructions facilitating use of same main engine-parts in different types**
- 69/02 • for different fuel types, other than engines indifferent to fuel consumed, e.g. convertible from light to heavy fuel
  - 69/04 • • for gaseous and non-gaseous fuels
  - 69/06 • for different cycles, e.g. convertible from two-stroke to four-stroke
- 71/00 Free-piston engines; Engines without rotary main shaft**
- 71/02 • Starting
  - 71/04 • Adaptations of such engines for special use; Combinations of such engines with apparatus driven thereby (aspects predominantly concerning driven apparatus, see the relevant classes for such apparatus)
  - 71/06 • • Free-piston combustion gas generators
- 73/00 Combinations of two or more engines, not otherwise provided for**
- 75/00 Other engines, e.g. single-cylinder engines**
- 75/02 • Engines characterised by their cycles, e.g. six-stroke
  - 75/04 • Engines with variable distances between pistons at top dead-centre positions and cylinder heads
  - 75/06 • Engines with means for equalising torque (compensations of inertial forces, suppression of vibration in systems F16F)
  - 75/08 • Engines with means for preventing corrosion in gas-swept spaces
  - 75/10 • Engines with means for rendering exhaust gases innocuous (apparatus for rendering exhaust gases innocuous *per se* F01N 3/08)
  - 75/12 • Other methods of operation
  - 75/16 • Engines characterised by number of cylinders, e.g. single-cylinder engines (F02B 75/26 takes precedence)
  - 75/18 • • Multi-cylinder engines (scavenging aspects F02B 25/00)
    - 75/20 • • • with cylinders all in one line
    - 75/22 • • • with cylinders in V-, fan-, or star-arrangement
    - 75/24 • • • with cylinders arranged oppositely relative to main shaft and of "flat" type
  - 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

## 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)
- 75/30 • • with one working piston sliding inside another
- 75/32 • Engines characterised by connections between pistons and main shafts and not specific to preceding main groups
- 75/34 • Ultra-small engines, e.g. for driving models
- 75/36 • Engines with parts of combustion- or working-chamber walls resiliently yielding under pressure
- 75/38 • • Reciprocating-piston engines (F02B 75/04 takes precedence; with resiliently-urged auxiliary piston in pre-combustion chamber F02B 19/06)
- 75/40 • Other reciprocating-piston engines

## 77/00 Component parts, details, or accessories, not otherwise provided for

- 77/02 • Surface coverings of combustion-gas-swept parts (of pistons or cylinders only F02F)
- 77/04 • Cleaning of, preventing corrosion or erosion in, or preventing unwanted deposits in, combustion engines
- 77/08 • Safety, indicating, or supervising devices (thermal insulation F02B 77/11; monitoring or diagnostic devices for exhaust-gas treatment apparatus F01N 11/00)
- 77/10 • • Safety means relating to crankcase explosions
- 77/11 • Thermal or acoustic insulation [3]
- 77/13 • • Acoustic insulation [3]
- 77/14 • Engine-driven auxiliary devices combined into units

## 79/00 Running-in of internal-combustion engines (lubrication thereof F01M)

**F02C GAS-TURBINE PLANTS; AIR INTAKES FOR JET-PROPULSION PLANTS; CONTROLLING FUEL SUPPLY IN AIR-BREATHING JET-PROPULSION PLANTS** (construction of turbines F01D; jet-propulsion plants F02K; construction of compressors or fans F04; combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles F23C 10/00; generating combustion products of high pressure or high velocity F23R; using gas turbines in compression refrigeration plants F25B 11/00; using gas-turbine plants in vehicles, see the relevant vehicle classes)

### Note(s)

1. This subclass covers:
  - combustion product or hot gas turbine plants;
  - internal combustion turbines or turbine plants;
  - turbine plants in which the working fluid is an unheated, pressurised gas.
2. This subclass does not cover:
  - steam turbine plants, which are covered by subclass F01K;
  - special vapour plants, which are covered by subclass F01K.
3. In this subclass, the following expression is used with the meaning indicated:
  - "gas-turbine plants" covers all the subject matter of Note (1) above and covers also features of jet-propulsion plants common to gas-turbine plants.
4. Attention is drawn to the Notes preceding class F01.

### 1/00 Gas-turbine plants characterised by the use of hot gases or unheated pressurised gases, as the working fluid (by the use of combustion products F02C 3/00, F02C 5/00) [3]

- 1/02 • the working fluid being an unheated pressurised gas [3]
- 1/04 • the working fluid being heated indirectly [3]
- 1/05 • • characterised by the type or source of heat, e.g. using nuclear or solar energy [3]
- 1/06 • • • using reheated exhaust gas (F02C 1/08 takes precedence) [3]
- 1/08 • • Semi-closed cycles [3]
- 1/10 • • Closed cycles [3]

### 3/00 Gas-turbine plants characterised by the use of combustion products as the working fluid (generated by intermittent combustion F02C 5/00)

- 3/02 • using exhaust-gas pressure in a pressure exchanger to compress combustion-air (pressure exchangers per se F04F 13/00)
- 3/04 • having a turbine driving a compressor (power transmission arrangements F02C 7/36; control of working fluid flow F02C 9/16) [5]
- 3/045 • • having compressor and turbine passages in a single rotor (F02C 3/073 takes precedence) [3]
- 3/05 • • • the compressor and the turbine being of the radial flow type [3]

- 3/055 • • the compressor being of the positive-displacement type [3]
- 3/06 • • the compressor comprising only axial stages (F02C 3/10 takes precedence) [3]
- 3/067 • • • having counter-rotating rotors (F02C 3/073 takes precedence) [3]
- 3/073 • • • the compressor and turbine stages being concentric [3]
- 3/08 • • the compressor comprising at least one radial stage (F02C 3/10 takes precedence) [3]
- 3/09 • • • of the centripetal type [3]
- 3/10 • • with another turbine driving an output shaft but not driving the compressor
- 3/107 • • with two or more rotors connected by power transmission [5]
- 3/113 • • • with variable power transmission between rotors [5]
- 3/13 • • having variable working fluid interconnections between turbines or compressors or stages of different rotors [5]
- 3/14 • characterised by the arrangement of the combustion chamber in the plant (combustion chambers per se F23R) [3]
- 3/16 • • the combustion chambers being formed at least partly in the turbine rotor
- 3/20 • using a special fuel, oxidant, or dilution fluid to generate the combustion products [3]

- 3/22 • • the fuel or oxidant being gaseous at standard temperature and pressure (F02C 3/28 takes precedence) [3]
- 3/24 • • the fuel or oxidant being liquid at standard temperature and pressure [3]
- 3/26 • • the fuel or oxidant being solid or pulverulent, e.g. in slurry or suspension
- 3/28 • • • using a separate gas producer for gasifying the fuel before combustion [3]
- 3/30 • • Adding water, steam or other fluids to the combustible ingredients or to the working fluid before discharge from the turbine (heating of air intakes to prevent icing F02C 7/047) [3]
- 3/32 • Inducing air flow by fluid jet, e.g. ejector action [3]
- 3/34 • with recycling of part of the working fluid, i.e. semi-closed cycles with combustion products in the closed part of the cycle [3]
- 3/36 • Open cycles [3]
- 5/00 Gas-turbine plants characterised by the working fluid being generated by intermittent combustion**
- 5/02 • characterised by the arrangement of the combustion chamber in the plant (combustion chambers *per se* F23R) [3]
- 5/04 • • the combustion chambers being formed at least partly in the turbine rotor
- 5/06 • the working fluid being generated in an internal-combustion gas generator of the positive-displacement type having essentially no mechanical power output (internal-combustion engines with prolonged expansion using exhaust gas turbines F02B)
- 5/08 • • the gas generator being of the free-piston type
- 5/10 • the working fluid forming a resonating or oscillating gas column, i.e. the combustion chambers having no positively actuated valves, e.g. using Helmholtz effect [3]
- 5/11 • • using valveless combustion chambers [3]
- 5/12 • the combustion chambers having inlet or outlet valves, e.g. Holzwarth gas-turbine plants
- 6/00 Plural gas-turbine plants; Combinations of gas-turbine plants with other apparatus** (aspects predominantly concerning such apparatus, *see* the relevant classes for the apparatus); **Adaptations of gas-turbine plants for special use** [3]
- 6/02 • Plural gas-turbine plants having a common power output [3]
- 6/04 • Gas-turbine plants providing heated or pressurised working fluid for other apparatus, e.g. without mechanical power output (F02C 6/18 takes precedence) [3]
- 6/06 • • providing compressed gas (F02C 6/10 takes precedence) [3]
- 6/08 • • • the gas being bled from the gas-turbine compressor [3]
- 6/10 • • supplying working fluid to a user, e.g. a chemical process, which returns working fluid to a turbine of the plant [3]
- 6/12 • • • Turbochargers, i.e. plants for augmenting mechanical power output of internal-combustion piston engines by increase of charge pressure [3]
- 6/14 • Gas-turbine plants having means for storing energy, e.g. for meeting peak loads [3]
- 6/16 • • for storing compressed air [3]
- 6/18 • using the waste heat of gas-turbine plants outside the plants themselves, e.g. gas-turbine power heat plants (using waste heat as source of energy for refrigeration plants F25B 27/02) [3]
- 6/20 • Adaptations of gas-turbine plants for driving vehicles [3]
- 7/00 Features, component parts, details or accessories, not provided for in, or of interest apart from, groups F02C 1/00-F02C 6/00; Air intakes for jet-propulsion plants** (controlling F02C 9/00) [3]
- 7/04 • Air intakes for gas-turbine plants or jet-propulsion plants [3]
- 7/042 • • having variable geometry [3]
- 7/045 • • having provisions for noise suppression [3]
- 7/047 • • Heating to prevent icing [3]
- 7/05 • • having provisions for obviating the penetration of damaging objects or particles [3]
- 7/052 • • • with dust-separation devices [3]
- 7/055 • • • with intake grids, screens or guards [3]
- 7/057 • • Control or regulation (conjointly with fuel supply control F02C 9/50, with nozzle area control F02K 1/16) [3]
- 7/06 • Arrangement of bearings (bearings F16C); Lubricating (of engines in general F01M) [3]
- 7/08 • Heating air supply before combustion, e.g. by exhaust gases
- 7/10 • • by means of regenerative heat-exchangers
- 7/105 • • • of the rotary type (rotary heat exchangers *per se* F28D) [3]
- 7/12 • Cooling of plants (of component parts, *see* the relevant subclasses, e.g. F01D; cooling of engines in general F01P)
- 7/14 • • of fluids in the plant
- 7/141 • • • of working fluid (F02C 3/30 takes precedence) [3]
- 7/143 • • • • before or between the compressor stages [3]
- 7/16 • • characterised by cooling medium
- 7/18 • • • the medium being gaseous, e.g. air
- 7/20 • Mounting or supporting of plant; Accommodating heat expansion or creep
- 7/22 • Fuel supply systems
- 7/224 • • Heating fuel before feeding to the burner [3]
- 7/228 • • Dividing fuel between various burners [3]
- 7/232 • • Fuel valves; Draining valves or systems (valves in general F16K) [3]
- 7/236 • • Fuel delivery systems comprising two or more pumps [3]
- 7/24 • Heat or noise insulation (air intakes having provisions for noise suppression F02C 7/045; turbine exhaust heads, chambers, or the like F01D 25/30; silencing nozzles of jet-propulsion plants F02K 1/00) [3]
- 7/25 • • Fire protection or prevention (in general A62) [3]
- 7/26 • Starting; Ignition
- 7/262 • • Restarting after flame-out [3]
- 7/264 • • Ignition [3]
- 7/266 • • • Electric (sparking plugs H01T) [3]
- 7/268 • • Starting drives for the rotor [3]
- 7/27 • • • Fluid drives (turbine starters F02C 7/277) [3]
- 7/272 • • • • generated by cartridges [3]
- 7/275 • • • Mechanical drives [3]
- 7/277 • • • • the starter being a turbine [3]
- 7/28 • Arrangement of seals
- 7/30 • Preventing corrosion in gas-swept spaces
- 7/32 • Arrangement, mounting, or driving, of auxiliaries

## F02C

- 7/36 • Power transmission between the different shafts of the gas-turbine plant, or between the gas-turbine plant and the power user (F02C 7/32 takes precedence; couplings for transmitting rotation F16D; gearing in general F16H) [3]
- 9/00 **Controlling gas-turbine plants; Controlling fuel supply in air-breathing jet-propulsion plants** (controlling air intakes F02C 7/057; controlling turbines F01D; controlling compressors F04D 27/00) [3]
- 9/16 • Control of working fluid flow (F02C 9/48 takes precedence; control of air-intake flow F02C 7/057) [3]
- 9/18 • • by bleeding, by-passing or acting on variable working fluid interconnections between turbines or compressors or their stages [3, 5]
- 9/20 • • by throttling; by adjusting vanes [3]
- 9/22 • • • by adjusting turbine vanes [3]
- 9/24 • • Control of the pressure level in closed cycles [3]
- 9/26 • Control of fuel supply (F02C 9/48 takes precedence; fuel valves F02C 7/232) [3]
- 9/28 • • Regulating systems responsive to plant or ambient parameters, e.g. temperature, pressure, rotor speed (F02C 9/30-F02C 9/38, F02C 9/44 take precedence) [3]
- 9/30 • • characterised by variable fuel pump output [3]
- 9/32 • • characterised by throttling of fuel (F02C 9/38 takes precedence) [3]
- 9/34 • • • Joint control of separate flows to main and auxiliary burners [3]
- 9/36 • • characterised by returning of fuel to sump (F02C 9/38 takes precedence) [3]
- 9/38 • • characterised by throttling and returning of fuel to sump [3]
- 9/40 • • specially adapted to the use of a special fuel or a plurality of fuels [3]
- 9/42 • • specially adapted for the control of two or more plants simultaneously [3]
- 9/44 • • responsive to the speed of aircraft, e.g. Mach number control, optimisation of fuel consumption [3]
- 9/46 • • Emergency fuel control [3]
- 9/48 • Control of fuel supply conjointly with another control of the plant (with nozzle section control F02K 1/17) [3]
- 9/50 • • with control of working fluid flow [3]
- 9/52 • • • by bleeding or by-passing the working fluid [3]
- 9/54 • • • by throttling the working fluid, by adjusting vanes [3]
- 9/56 • • with power transmission control [3]
- 9/58 • • • with control of a variable-pitch propeller [3]

**F02D CONTROLLING COMBUSTION ENGINES** (vehicle fittings, acting on a single sub-unit only, for automatically controlling vehicle speed B60K 31/00; conjoint control of vehicle sub-units of different type or different function, road vehicle drive control systems for purposes other than the control of a single sub-unit B60W; cyclically operating valves for combustion engines F01L; controlling combustion engine lubrication F01M; cooling internal-combustion engines F01P; supplying combustion engines with combustible mixtures or constituents thereof, e.g. carburettors, injection pumps, F02M; starting of combustion engines F02N; controlling of ignition F02P; controlling gas-turbine plants, jet-propulsion plants, or combustion-product engine plants, see the relevant subclasses for these plants) [4, 2006.01]

### Note(s)

1. In this subclass, the following term or expression is used with the meanings indicated:
  - "fuel injection" means the introduction of a combustible substance into a space, e.g. cylinder, by means of a pressure source, e.g. a pump, continuously or cyclically acting behind the substance;
  - "supercharging" means supplying to the working space, e.g. cylinder, combustion-air pressurised by means of a pressure source, e.g. a pump.
2. Attention is drawn to the Notes preceding class F01.
3. In this subclass, electrical aspects of control arrangements are classified in groups F02D 41/00-F02D 45/00.

### Subclass index

#### CONTROLLING COMBUSTION ENGINES IN GENERAL

Characterised by action on engine operation

- on injection: general; low pressure; other means.....1/00, 3/00, 7/00
- by throttling air or fuel-and-air induction or exhaust.....9/00
- on valve-operating cycle; varying compression ratio.....13/00, 15/00
- cutting-out cylinders, rendering engines inoperative or idling.....17/00
- on delivery of fuel or combustion-air, not otherwise provided for.....33/00
- on two or more associated functions not otherwise provided for.....37/00

Characterised by initiating or actuating means

- non-automatic initiation, e.g. by operator.....11/00
- initiation by speed-sensing governors or by interior or exterior conditions, not otherwise provided for.....31/00, 35/00

Programme control.....28/00

#### CONTROL OF PARTICULAR ENGINES

- engines: characterised by fuel; by combustion medium used; by supercharge.....19/00, 21/00, 23/00
- co-operating engines; reversible engines; engines driving vehicle or particular devices.....25/00, 27/00, 29/00

#### OTHER CONTROL

- Non-electrical.....39/00
- Electrical.....41/00-45/00

**Controlling, e.g. regulating, fuel injection**

- 1/00 Controlling fuel-injection pumps, e.g. of high-pressure injection type** (F02D 3/00 takes precedence) [2]
- 1/02 • not restricted to adjustment of injection timing, e.g. varying amount of fuel delivered
- 1/04 • • by mechanical means dependent on engine speed, e.g. using centrifugal governors (F02D 1/08 takes precedence)
- 1/06 • • by means dependent on pressure of engine working fluid (F02D 1/08 takes precedence)
- 1/08 • • Transmission of control impulse to pump control, e.g. with power drive or power assistance
- 1/10 • • • mechanical
- 1/12 • • • non-mechanical, e.g. hydraulic
- 1/14 • • • pneumatic
- 1/16 • Adjustment of injection timing (F02D 1/02 takes precedence)
- 1/18 • • with non-mechanical means for transmitting control impulse; with amplification of control impulse
- 3/00 Controlling low-pressure fuel injection, i.e. where the air-fuel mixture containing fuel thus injected will be substantially compressed by the compression stroke of the engine, by means other than controlling only an injection pump** (carburetors F02M) [2]
- Note(s)**  
When the control apparatus or system forms part of the low-pressure fuel-injection apparatus it is classified in group F02M 69/00.
- 3/02 • with continuous injection or continuous flow upstream of the injection nozzle [2]
- 3/04 • Controlling fuel injection and carburation, e.g. of alternative systems
- 7/00 Other non-electrical fuel injection control** [4]
- 7/02 • Controlling fuel injection where fuel is injected by compressed air

- 9/00 Controlling engines by throttling air or fuel-and-air induction conduits or exhaust conduits**
- 9/02 • concerning induction conduits (throttle valves, or arrangements thereof in conduits F02D 9/08)
- 9/04 • concerning exhaust conduits (throttle valves, or arrangements thereof in conduits F02D 9/08)
- 9/06 • • Exhaust brakes
- 9/08 • Throttle valves specially adapted therefor; Arrangements of such valves in conduits (throttle valves modified for use in, or arranged in, carburetors F02M; throttle valves in general F16K)
- 9/10 • • having pivotally-mounted flaps
- 9/12 • • having slidably-mounted valve-members; having valve-members movable longitudinally of conduit
- 9/14 • • • the members being slidable transversely of conduit
- 9/16 • • • the members being rotatable
- 9/18 • • having elastic-wall valve-members

- 11/00 Arrangements for, or adaptations to, non-automatic engine control initiation means, e.g. operator initiated** (specially for reversing F02D 27/00; arrangement or mounting of prime-mover control devices in vehicles B60K 26/00) [2, 5]
- 11/02 • characterised by hand, foot, or like operator controlled initiation means [5]
- 11/04 • characterised by mechanical control linkages (with power drive or assistance F02D 11/06) [5]
- 11/06 • characterised by non-mechanical control linkages, e.g. fluid control linkages or by control linkages with power drive or assistance [5]
- 11/08 • • of the pneumatic type [5]
- 11/10 • • of the electric type [5]
- 13/00 Controlling the engine output power by varying inlet or exhaust valve operating characteristics, e.g. timing** (modifying valve gear F01L)
- 13/02 • during engine operation
- 13/04 • • using engine as brake
- 13/06 • • Cutting-out cylinders
- 13/08 • for rendering engine inoperative or idling
- 15/00 Varying compression ratio** (modifying valve-gear F01L)
- 15/02 • by alteration or displacement of piston stroke
- 15/04 • by alteration of volume of compression space without changing piston stroke
- 17/00 Controlling engines by cutting-out individual cylinders; Rendering engines inoperative or idling** (controlling or rendering inoperative by varying inlet or exhaust valve operating characteristics F02D 13/00)
- 17/02 • Cutting-out (cutting-out engines in multiple-engine arrangements F02D 25/04)
- 17/04 • rendering engines inoperative or idling, e.g. caused by abnormal conditions (dependent on lubricating conditions F01M 1/22; dependent on cooling F01P 5/14)

**Controlling peculiar to specified types or adaptations of engines**

- 19/00 Controlling engines characterised by their use of non-liquid fuels, pluralities of fuels, or non-fuel substances added to the combustible mixtures** (the non-fuel substances being gaseous F02D 21/00)
- 19/02 • peculiar to engines working with gaseous fuels (apparatus, or control parts thereof, for mixing gas and air F02M)
- 19/04 • peculiar to engines working with solid fuels, e.g. pulverised coal
- 19/06 • peculiar to engines working with pluralities of fuels, e.g. alternatively with light and heavy fuel oil, other than engines indifferent to the fuel consumed
- 19/08 • • simultaneously using pluralities of fuels (F02D 19/12 takes precedence)
- 19/10 • • • peculiar to compression-ignition engines in which the main fuel is gaseous
- 19/12 • peculiar to engines working with non-fuel substances or with anti-knock agents, e.g. with anti-knock fuel (apparatus, or control parts thereof, for delivering such substances or agents F02M)

## F02D

- 21/00 Controlling engines characterised by their being supplied with non-airborne oxygen or other non-fuel gas**
- 21/02 • peculiar to oxygen-fed engines
  - 21/04 • • with circulation of exhaust gases in closed or semi-closed circuits
  - 21/06 • peculiar to engines having other non-fuel gas added to combustion-air
  - 21/08 • • the other gas being the exhaust gas of engine (circulation of exhaust gas in oxygen-fed engines F02D 21/04)
  - 21/10 • • having secondary air added to fuel-air mixture (apparatus, or control parts thereof, for delivering secondary air F02M)
- 23/00 Controlling engines characterised by their being supercharged**
- 23/02 • the engines being of fuel-injection type
- 25/00 Controlling two or more co-operating engines**
- 25/02 • to synchronise speed
  - 25/04 • by cutting-out engines
- 27/00 Controlling engines characterised by their being reversible**
- 27/02 • by performing a programme
- 28/00 Programme-control of engines** (programme-control specific to a type or purpose covered by one of the groups of this subclass, except groups F02D 29/00, F02D 39/00, or by one group of another subclass, e.g. of F01L, see that group) [2]
- 29/00 Controlling engines, such controlling being peculiar to the devices driven thereby, the devices being other than parts or accessories essential to engine operation, e.g. controlling of engines by signals external thereto** [2]
- 29/02 • peculiar to engines driving vehicles; peculiar to engines driving variable-pitch propellers [2]
  - 29/04 • peculiar to engines driving pumps
  - 29/06 • peculiar to engines driving electric generators

### Other non-electrical control of combustion engines [4]

- 31/00 Use of non-electrical speed-sensing governors to control combustion engines, not otherwise provided for**
- 33/00 Non-electrical control of delivery of fuel or combustion-air, not otherwise provided for**
- 33/02 • of combustion-air
- 35/00 Non-electrical control of engines, dependent on conditions exterior or interior to engines, not otherwise provided for**
- 35/02 • on interior conditions
- 37/00 Non-electrical conjoint control of two or more functions of engines, not otherwise provided for**
- 37/02 • one of the functions being ignition (ignition control per se F02P)
- 39/00 Other non-electrical control** [4]
- 39/02 • for four-stroke engines
  - 39/04 • for engines with other cycles than four-stroke, e.g. two-stroke
  - 39/06 • for engines adding the fuel substantially at end of compression stroke

- 39/08 • for engines adding the fuel substantially before compression stroke
- 39/10 • for free-piston engines; for engines without rotary main shaft

### Electrical control of combustion engines [4]

#### Note(s)

1. Groups F02D 41/00-F02D 45/00 cover electrical aspects of electrically controlled devices.
2. Groups F02D 41/00-F02D 45/00 do not cover:
  - non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00-F02D 39/00 or by subclass F02M;
  - both electrical and non-electrical aspects of electrically controlled devices, which are covered by groups F02D 1/00-F02D 39/00 or by subclass F02M.

### **41/00 Electrical control of supply of combustible mixture or its constituents** (F02D 43/00 takes precedence) [4]

- 41/02 • Circuit arrangements for generating control signals [4]
  - 41/04 • • Introducing corrections for particular operating conditions (F02D 41/14 takes precedence) [4]
  - 41/06 • • • for engine starting or warming up [4]
  - 41/08 • • • for idling (F02D 41/06, F02D 41/16 take precedence) [4]
  - 41/10 • • • for acceleration [4]
  - 41/12 • • • for deceleration [4]
  - 41/14 • • Introducing closed-loop corrections [4]
  - 41/16 • • • for idling [4]
  - 41/18 • • by measuring intake air flow (measuring flow, in general G01F) [4]
  - 41/20 • Output circuits, e.g. for controlling currents in command coils (current control in inductive loads in general H03K 17/64) [4]
  - 41/22 • Safety or indicating devices for abnormal conditions [4]
  - 41/24 • characterised by the use of digital means [4]
  - 41/26 • • using computer, e.g. microprocessor [4]
  - 41/28 • • • Interface circuits [4]
  - 41/30 • Controlling fuel injection [4]
  - 41/32 • • of the low pressure type [4]
  - 41/34 • • • with means for controlling injection timing or duration (ignition timing F02P 5/00) [4]
  - 41/36 • • • with means for controlling distribution (arrangement of ignition distributors F02P 7/00) [4]
  - 41/38 • • of the high pressure type [4]
  - 41/40 • • • with means for controlling injection timing or duration [4]
- 43/00 Conjoint electrical control of two or more functions, e.g. ignition, fuel-air mixture, recirculation, supercharging, exhaust-gas treatment** (electrical control of exhaust gas treating apparatus per se F01N 9/00) [4]
- 43/02 • using only analogue means [4]
  - 43/04 • using only digital means [4]

- 45/00 Electrical control not provided for in groups F02D 41/00-F02D 43/00** (electrical control of exhaust gas treating apparatus F01N 9/00; electrical control of one of the functions: ignition, lubricating, cooling, starting, intake-heating, see the relevant subclasses for such functions) [4]
- F02F CYLINDERS, PISTONS, OR CASINGS FOR COMBUSTION ENGINES; ARRANGEMENTS OF SEALINGS IN COMBUSTION ENGINES** (specially adapted for rotary-piston or oscillating-piston internal-combustion engines F02B; specially adapted for gas-turbine plants F02C; specially adapted for jet-propulsion plants F02K) [2]

**Note(s)**

- Attention is drawn to the Notes preceding class F01.
- Class F16 takes precedence over this subclass, except for subject matter specific to combustion engines.

<b>1/00</b>	<b>Cylinders; Cylinder heads</b> (in general F16J)	1/42	• • Shape or arrangement of intake or exhaust channels in cylinder heads
1/02	• having cooling means (cylinder heads F02F 1/26)		
1/04	• • for air cooling		
1/06	• • • Shape or arrangement of cooling fins; Finned cylinders	<b>3/00</b>	<b>Pistons</b> (in general F16J)
1/08	• • • running-liner and cooling-part of cylinder being different parts or of different material	3/02	• having means for accommodating or controlling heat expansion
1/10	• • for liquid cooling	3/04	• • having expansion-controlling inserts
1/12	• • • Preventing corrosion of liquid-swept surfaces	3/06	• • • the inserts having bimetallic effect
1/14	• • • Cylinders with means for directing, guiding, or distributing liquid stream	3/08	• • • the inserts being ring-shaped
1/16	• • • Cylinder liners of wet type	3/10	• having surface coverings (F02F 3/02 takes precedence)
1/18	• Other cylinders	3/12	• • on piston heads
1/20	• • characterised by constructional features providing for lubrication	3/14	• • • within combustion chambers
1/22	• • characterised by having ports in cylinder wall for scavenging or charging	3/16	• having cooling means
1/24	• Cylinder heads	3/18	• • the means being a liquid or solid coolant, e.g. sodium, in a closed chamber in piston
1/26	• • having cooling means	3/20	• • the means being a fluid flowing through or along piston
1/28	• • • for air cooling	3/22	• • • the fluid being liquid
1/30	• • • • Finned cylinder heads	3/24	• having means for guiding gases in cylinders, e.g. for guiding scavenging charge in two-stroke engines
1/32	• • • • the cylinder heads being of overhead-valve type	3/26	• having combustion chamber in piston head (the surface thereof being covered F02F 3/14)
1/34	• • • • with means for directing or distributing cooling medium (F02F 1/32 takes precedence)	3/28	• Other pistons with specially-shaped head
1/36	• • • for liquid cooling	<b>5/00</b>	<b>Piston rings, e.g. associated with piston crown</b>
1/38	• • • • the cylinder heads being of overhead-valve type	<b>7/00</b>	<b>Casings, e.g. crankcases</b> (engine casings in general F16M)
1/40	• • • • cylinder heads with means for directing, guiding, or distributing liquid stream (F02F 1/38 takes precedence)	<b>11/00</b>	<b>Arrangements of sealings in combustion engines</b> (piston rings F02F 5/00; sealings <u>per se</u> F16J)

- F02G HOT-GAS OR COMBUSTION-PRODUCT POSITIVE-DISPLACEMENT ENGINE PLANTS** (steam engine plants, special vapour plants, plants operating on either hot gas or combustion-product gases together with other fluid F01K; gas-turbine plants F02C; jet-propulsion plants F02K); **USE OF WASTE HEAT OF COMBUSTION ENGINES, NOT OTHERWISE PROVIDED FOR**

**Note(s)**

Attention is drawn to the Notes preceding class F01.

<b>1/00</b>	<b>Hot gas positive-displacement engine plants</b> (positive-displacement engine plants characterised by the working gas being generated by combustion in the plant F02G 3/00) [3]	1/043	• • the engine being operated by expansion and contraction of a mass of working gas which is heated and cooled in one of a plurality of constantly communicating expansible chambers, e.g. Stirling cycle type engines [3]
1/02	• of open-cycle type	1/044	• • • having at least two working members, e.g. pistons, delivering power output [3]
1/04	• of closed-cycle type	1/045	• • • Controlling [3]

**F02G**

- 1/047 • • • • by varying the heating or cooling [3]
- 1/05 • • • • by varying the rate of flow or quantity of the working gas [3]
- 1/053 • • • Component parts or details [3]
- 1/055 • • • • Heaters or coolers [3]
- 1/057 • • • • Regenerators [3]
- 1/06 • Controlling

- 3/00 Positive-displacement engine plants characterised by the working gas being generated by combustion in the plant [3]**
- 3/02 • with reciprocating-piston engines
- 5/00 Profiting from waste heat of combustion engines, not otherwise provided for**
- 5/02 • Profiting from waste heat of exhaust gases
- 5/04 • • in combination with other waste heat from combustion engines

**F02K JET-PROPULSION PLANTS** (arrangement or mounting of jet-propulsion plants in land vehicles or vehicles in general B60K; arrangement or mounting of jet-propulsion plants in waterborne vessels B63H; controlling aircraft attitude, flight direction, or altitude by jet reaction B64C; arrangement or mounting of jet-propulsion plants in aircraft B64D; plants characterised by the power of the working fluid being divided between jet propulsion and another form of propulsion, e.g. propeller, F02B, F02C; features of jet-propulsion plants common to gas-turbine plants, air intakes or fuel supply control of air-breathing jet-propulsion plants F02C)

**Note(s)**

1. In this subclass, the following expression is used with the meaning indicated:
  - "jet-propulsion plants" means plants using combustion to produce a fluid stream from which a propulsive thrust on the plants is obtained on the reaction principle.
2. Attention is drawn to the Notes preceding class F01.

**Subclass index**

PLANTS CHARACTERISED BY JET PIPE OR NOZZLE.....	1/00, 9/80
PLANTS WITH COMPRESSOR OR FAN.....	3/00, 5/00
PLANTS WITHOUT COMPRESSOR OR FAN.....	7/00
ROCKET-ENGINE PLANTS.....	9/00
CONTROL.....	1/15, 1/76, 7/00, 9/00
OTHER PLANTS.....	99/00

- 
- 1/00 Plants characterised by the form or arrangement of the jet pipe or nozzle; Jet pipes or nozzles peculiar thereto** (rocket nozzles F02K 9/97)
  - 1/04 • Mounting of an exhaust cone in the jet pipe
  - 1/06 • Varying effective area of jet pipe or nozzle (F02K 1/30 takes precedence) [3]
  - 1/08 • • by axially moving or transversely deforming an internal member, e.g. the exhaust cone
  - 1/09 • • by axially moving an external member, e.g. a shroud (F02K 1/12 takes precedence) [3]
  - 1/10 • • by distorting the jet pipe or nozzle
  - 1/11 • • by means of pivoted eyelids [3]
  - 1/12 • • by means of pivoted flaps
  - 1/15 • • Control or regulation [3]
  - 1/16 • • • conjointly with another control [3]
  - 1/17 • • • • with control of fuel supply [3]
  - 1/18 • • • automatic [3]
  - 1/28 • using fluid jets to influence the jet flow [3]
  - 1/30 • • for varying effective area of jet pipe or nozzle [3]
  - 1/32 • • for reversing thrust [3]
  - 1/34 • • for attenuating noise [3]
  - 1/36 • having an ejector [3]
  - 1/38 • Introducing air inside the jet (F02K 1/28 takes precedence) [3]
  - 1/40 • Nozzles having means for dividing the jet into a plurality of partial jets or having an elongated cross-section outlet [3]
  - 1/42 • • the means being movable into an inoperative position [3]
  - 1/44 • Nozzles having means, e.g. a shield, reducing sound radiation in a specified direction (F02K 1/40 takes precedence) [3]
  - 1/46 • Nozzles having means for adding air to the jet or for augmenting the mixing region between the jet and the ambient air, e.g. for silencing (F02K 1/28, F02K 1/36, F02K 1/38 take precedence) [3]
  - 1/48 • • Corrugated nozzles [3]
  - 1/50 • • Deflecting outwardly a portion of the jet by retractable scoop-like baffles [3]
  - 1/52 • Nozzles specially constructed for positioning adjacent to another nozzle or to a fixed member, e.g. fairing [3]
  - 1/54 • Nozzles having means for reversing jet thrust (F02K 1/32 takes precedence) [3]
  - 1/56 • • Reversing jet main flow [3]
  - 1/58 • • • Reversers mounted on the inner cone or the nozzle housing [3]
  - 1/60 • • • by blocking the rearward discharge by means of pivoted eyelids or clamshells, e.g. target-type reversers [3]
  - 1/62 • • • by blocking the rearward discharge by means of flaps [3]
  - 1/64 • • Reversing fan flow [3]
  - 1/66 • • • using reversing fan blades [3]
  - 1/68 • • • Reversers mounted on the engine housing downstream of the fan exhaust section [3]
  - 1/70 • • • using thrust reverser flaps or doors mounted on the fan housing [3]
  - 1/72 • • • • the aft end of the fan housing being movable to uncover openings in the fan housing for the reversed flow [3]

- 1/74 • • Reversing at least one flow in relation to at least one other flow in a plural-flow engine [3]
- 1/76 • • Control or regulation of thrust reversers [3]
- 1/78 • Other construction of jet pipes [3]
- 1/80 • • Couplings or connections [3]
- 1/82 • • Jet pipe walls, e.g. liners [3]
- 3/00 Plants including a gas turbine driving a compressor or a ducted fan**
- 3/02 • in which part of the working fluid by-passes the turbine and combustion chamber
- 3/04 • • the plant including ducted fans, i.e. fans with high volume, low-pressure outputs, for augmenting jet thrust, e.g. of double-flow type
  - 3/06 • • • with front fan
  - 3/062 • • • with aft fan [3]
  - 3/065 • • • with front and aft fans [3]
  - 3/068 • • • being characterised by a short axial length relative to diameter [3]
  - 3/072 • • • with counter-rotating rotors [3]
  - 3/075 • • • controlling flow ratio between flows [3]
  - 3/077 • • • the plant being of the multiple flow type, i.e. having three or more flows [3]
- 3/08 • with supplementary heating of the working fluid (after-burners, combustion chambers F23R); Control thereof (control of fuel supply therefor F02C 9/26) [3]
- 3/10 • • by after-burners (F02K 3/105 takes precedence) [3]
- 3/105 • • Heating the by-pass flow [3]
- 3/11 • • • by means of burners or combustion chambers [3]
- 3/115 • • • by means of indirect heat exchange [3]
- 3/12 • characterised by having more than one gas turbine
- 5/00 Plants including an engine, other than a gas turbine, driving a compressor or a ducted fan**
- 5/02 • the engine being of the reciprocating-piston type
- 7/00 Plants in which the working-fluid is used in a jet only, i.e. the plants not having a turbine or other engine driving a compressor or a ducted fan; Control thereof (rocket-engine plants F02K 9/00)**
- 7/02 • the jet being intermittent, i.e. pulse jet
  - 7/04 • • with resonant combustion chambers
  - 7/06 • • with combustion chambers having valves
  - 7/067 • • • having aerodynamic valves [3]
  - 7/075 • • with multiple pulse-jet engines [3]
- 7/08 • the jet being continuous
- 7/10 • characterised by having ram-action compression, i.e. aero-thermo-dynamic-ducts or ram-jet engines
  - 7/12 • • Injection-induction jet engines [3]
  - 7/14 • • with external combustion, e.g. scram-jet engines [3]
  - 7/16 • • Composite ram-jet/turbo-jet engines [3]
  - 7/18 • • Composite ram-jet/rocket engines [3]
  - 7/20 • • Composite ram-jet/pulse-jet engines [3]
- 9/00 Rocket-engine plants, i.e. plants carrying both fuel and oxidant therefor; Control thereof (chemical composition of propellants C06B, C06D) [3]**
- 9/08 • using solid propellants (F02K 9/72 takes precedence; using semi-solid or pulverulent propellants F02K 9/70) [3]
  - 9/10 • • Shape or structure of solid propellant charges [3]
  - 9/12 • • • made of two or more portions burning at different rates [3]
- 9/14 • • • made from sheet-like materials, e.g. of carpet-roll type, of layered structure [3]
- 9/16 • • • of honeycomb structure [3]
- 9/18 • • • of the internal-burning type having a star or like shaped internal cavity [3]
- 9/20 • • • of the external-burning type [3]
- 9/22 • • • of the front-burning type [3]
- 9/24 • • Charging rocket engines with solid propellants; Methods or apparatus specially adapted for working solid propellant charges [3]
  - 9/26 • • Burning control [3]
  - 9/28 • • having two or more propellant charges with the propulsion gases exhausting through a common nozzle [3]
    - 9/30 • • with the propulsion gases exhausting through a plurality of nozzles [3]
  - 9/32 • • Constructional parts; Details (shape or structure of solid propellant charges F02K 9/10; starting or ignition means or arrangements F02K 9/95; rocket nozzles F02K 9/97) [3]
    - 9/34 • • • Casings; Combustion chambers; Liners thereof [3]
    - 9/36 • • • Propellant charge supports [3]
    - 9/38 • • • Safety devices, e.g. to prevent accidental ignition [3]
      - 9/40 • • • Cooling arrangements [3]
    - 9/42 • • using liquid or gaseous propellants (F02K 9/72 takes precedence) [3]
      - 9/44 • • Feeding propellants [3]
        - 9/46 • • • using pumps (pumps *per se* F04) [3]
          - 9/48 • • • • driven by a gas turbine fed by propellant combustion gases [3]
        - 9/50 • • • using pressurised fluid to pressurize the propellants [3]
          - 9/52 • • • Injectors (in general B05B) [3]
      - 9/54 • • • Leakage detectors; Purging systems; Filtration systems (filters *per se* B01D) [3]
        - 9/56 • • • Control [3]
        - 9/58 • • • • Propellant feed valves (valves in general F16K) [3]
    - 9/60 • • Constructional parts; Details (starting or ignition means or arrangements F02K 9/95; rocket nozzles F02K 9/97) [3]
      - 9/62 • • • Combustion or thrust chambers [3]
        - 9/64 • • • • having cooling arrangements [3]
          - 9/66 • • • • of the rotary type [3]
        - 9/68 • • • Decomposition chambers [3]
      - 9/70 • using semi-solid or pulverulent propellants [3]
      - 9/72 • using liquid and solid propellants, i.e. hybrid rocket-engine plants [3]
        - 9/74 • combined with another jet-propulsion plant [3]
        - 9/76 • with another rocket-engine plant; Multistage rocket-engine plants [3]
          - 9/78 • • with an air-breathing jet-propulsion plant (with a ram-jet engine F02K 7/18) [3]
        - 9/80 • characterised by thrust or thrust vector control (F02K 9/26, F02K 9/56, F02K 9/94 take precedence) [3]
          - 9/82 • • by injection of a secondary fluid into the rocket exhaust gases [3]
          - 9/84 • • using movable nozzles [3]
          - 9/86 • • using nozzle throats of adjustable cross-section [3]
          - 9/88 • • using auxiliary rocket nozzles [3]
          - 9/90 • • using deflectors (F02K 9/82 takes precedence) [3]
          - 9/92 • • incorporating means for reversing or terminating thrust [3]

## F02K

- |      |  |              |   |
|------|--|--------------|---|
| 9/94 | • Re-ignitable or restartable rocket-engine plants; Intermittently operated rocket-engine plants [3] | 9/97         | • Rocket nozzles (thrust or thrust vector control F02K 9/80) [3]                  |
| 9/95 | • characterised by starting or ignition means or arrangements (safety devices F02K 9/38) [3]         | <b>99/00</b> | <b>Subject matter not provided for in other groups of this subclass [2009.01]</b> |
| 9/96 | • characterised by specially adapted arrangements for testing or measuring [3]                       |              |   |

## F02M SUPPLYING COMBUSTION ENGINES IN GENERAL WITH COMBUSTIBLE MIXTURES OR CONSTITUENTS THEREOF (charging such engines F02B)

### Note(s)

- In this subclass, the following terms or expressions are used with the meanings indicated:
  - "carburettors" means essentially apparatus for mixing fuel with air, the fuel being brought into mixing contact with the air by lowering the air pressure, e.g. in a venturi;
  - "fuel-injection apparatus" means apparatus for introducing fuel into a space, e.g. engine cylinder, by pressurising the fuel, e.g. by a pump acting behind the fuel, and thus includes the so-called "solid-fuel injection" in which liquid fuel is introduced without any admixture of gas;
  - "low-pressure fuel injection" means fuel injection in which the fuel-air mixture containing fuel thus injected will be substantially compressed in the compression stroke of the engine;
  - "pumping element" means a single piston-cylinder unit in a reciprocating-piston fuel-injection pump or the equivalent unit in any other type of fuel-injection pump.
- Attention is drawn to the Notes preceding class F01.

### Subclass index

#### SUPPLYING WITH LIQUID FUEL

##### Carburettors

- |   |                              |
|---|------------------------------|
| starting, idling; float-controlled fuel level; mixture control; throttling, mixing chambers.....                | 1/00, 3/00, 5/00, 7/00, 9/00 |
| heating, cooling, insulating.....   | 15/00                        |
| multi-stage, register type; combinations of carburettors or fuels; combination with low-pressure injection..... | 11/00, 13/00, 71/00          |
| other characteristics; other details, or accessories.....   | 17/00, 19/00                 |

##### Injection apparatus

- |   |                     |
|---|---------------------|
| general characteristics, injection without gas  |                     |
| with two or more sequentially-fed injectors; with two or more liquids.....                    | 41/00, 43/00        |
| with cyclic delivery characteristics; with fluid-actuated valves.....                         | 45/00, 47/00        |
| with pump or injector actuated by cylinder pressure or by the piston.....                     | 49/00               |
| electrically-operated.....  | 51/00               |
| with heating, cooling, or insulating means; characterised by fuel pipes or venting means..... | 53/00, 55/00        |
| injectors combined with other devices.....  | 57/00               |
| arrangements of apparatus relative to engine, related pump drives.....                        | 39/00               |
| other adaptations of pumps; other injectors.....  | 59/00, 61/00        |
| other apparatus, details, or accessories.....   | 63/00, 69/00        |
| testing.....  | 65/00               |
| using high-pressure gas.....  | 67/00               |
| low-pressure apparatus.....   | 51/02, 69/00, 71/00 |

#### SUPPLYING WITH NON-LIQUID FUEL.....21/00

#### FEEDING OR PRETREATING AIR, FUEL, OR FUEL-AIR MIXTURE

##### Pre-treating fuel, air, or mixture

- |   |                     |
|---|---------------------|
| adding secondary air; adding non-fuel substances or secondary fuel.....               | 23/00, 25/00        |
| by catalytic, electrical, or magnetic means, or by sound or radiation; thermally..... | 27/00, 31/00        |
| by re-atomising or homogenising; air cleaning; other treatment.....                   | 29/00, 35/00, 33/00 |

##### Air intakes or silencers, induction systems.....35/00

##### Fuel transfer to carburettors or injection apparatus.....37/00

#### SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

### Carburettors for liquid fuels

- |             |   |
|-------------|---|
| 1/02        | • the means to facilitate starting or idling being chokes for enriching fuel-air mixture (automatic chokes F02M 1/08) |
| <b>1/00</b> | <b>Carburettors with means for facilitating engine's starting or its idling below operational temperatures</b>        |

- 1/04 • the means to facilitate starting or idling being auxiliary carburetting apparatus able to be put into, and out of, operation, e.g. having automatically-operated disc valves
- 1/06 • • having axially-movable valves, e.g. piston-shaped
- 1/08 • the means to facilitate starting or idling becoming operative or inoperative automatically (in connection with auxiliary carburetting apparatus F02M 1/04)
- 1/10 • • dependent on engine temperature, e.g. having thermostat
- 1/12 • • • with means for electrically heating thermostat
- 1/14 • • dependent on pressure in combustion-air- or fuel-air-mixture intake (F02M 1/10 takes precedence)
- 1/16 • Other means for enriching fuel-air mixture during starting; Priming cups; using different fuels for starting and normal operation
- 1/18 • • Enriching fuel-air mixture by depressing float to flood carburettor
- 3/00 Idling devices for carburettors** (with means for facilitating idling below operational temperatures F02M 1/00)
- 3/02 • Preventing flow of idling fuel
- 3/04 • • under conditions where engine is driven instead of driving, e.g. driven by vehicle running down hill
- 3/045 • • • Control of valves situated in the idling nozzle system, or the passage system, by electrical means or by a combination of electrical means with fluidic or mechanical means [4]
- 3/05 • • • Pneumatic or mechanical control, e.g. with speed regulation [4]
- 3/055 • • • Fuel flow cut-off by introducing air, e.g. brake air, into the idling fuel system [4]
- 3/06 • Increasing idling speed
- 3/07 • • by positioning the throttle flap stop, or by changing the fuel flow cross-sectional area, by electrical, electromechanical or electropneumatal means, according to engine speed [4]
- 3/08 • Other details of idling devices (fighting ice-formation by heating idling ports F02M 15/02)
- 3/09 • • Valves responsive to engine conditions, e.g. manifold vacuum (F02M 1/00, F02M 5/00-F02M 33/00 take precedence) [5]
- 3/10 • • Fuel metering pins; Nozzles [4]
- 3/12 • • Passage way systems [4]
- 3/14 • • Location of idling system outlet relative to throttle valve [4]
- 5/00 Float-controlled apparatus for maintaining a constant fuel level in carburettors**
- 5/02 • with provisions to meet variations in carburettor position, e.g. upside-down position in aircraft
- 5/04 • • with pivotally or rotatably mounted float chambers [4]
- 5/06 • having adjustable float mechanism, e.g. to meet dissimilarities in specific gravity of different fuels
- 5/08 • having means for venting float chambers
- 5/10 • having means for preventing vapour lock, e.g. insulated float chambers or forced fuel circulation through float chamber with engine stopped
- 5/12 • Other details, e.g. floats, valves, setting devices or tools (floats in general F16K 33/00)
- 5/16 • • Floats [4]
- 7/00 Carburettors with means for influencing, e.g. enriching or keeping constant, fuel/air ratio of charge under varying conditions** (choke valves for starting F02M 1/00)
- 7/02 • Carburettors having aerated fuel spray nozzles (with valve control for amount of air for aerating fuel F02M 7/24)
- 7/04 • Means for enriching charge at high combustion-air flow
- 7/06 • Means for enriching charge on sudden throttle opening, i.e. at acceleration, e.g. storage means in passage way system
- 7/08 • • using pumps
- 7/087 • • • changing output according to temperature in engine [4]
- 7/093 • • • changing output according to intake vacuum [4]
- 7/10 • Other installations, without moving parts, for influencing fuel/air ratio, e.g. electrical means (F02M 7/23 takes precedence) [4]
- 7/11 • • Altering float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) [5]
- 7/12 • Other installations, with moving parts, for influencing fuel/air ratio, e.g. having valves (F02M 7/24 takes precedence) [4]
- 7/127 • • Altering the float-chamber pressure (enriching the fuel-air mixture during starting by depressing float to flood carburettor F02M 1/18) [5]
- 7/133 • • Auxiliary jets, i.e. operating only under certain conditions, e.g. full power (F02M 7/04, F02M 7/06 take precedence) [5]
- 7/14 • • with means for controlling cross-sectional area of fuel spray nozzle (dependent on air-throttle valve position F02M 7/22)
- 7/16 • • • operated automatically, e.g. dependent on exhaust-gas analysis
- 7/17 • • • • by a pneumatically adjustable piston-like element, e.g. constant depression carburettors [5]
- 7/18 • • with means for controlling cross-sectional area of fuel-metering orifice (dependent on air-throttle position F02M 7/22)
- 7/20 • • • operated automatically, e.g. dependent on altitude
- 7/22 • • fuel flow cross-sectional area being controlled dependent on air-throttle-valve position (the throttle valve being slidably arranged transversely to air passage F02M 9/06)
- 7/23 • Fuel aerating devices [4]
- 7/24 • • Controlling flow of aerating air [4]
- 7/26 • • • dependent on position of optionally operable throttle means [4]
- 7/28 • • • dependent on temperature or pressure [4]
- 9/00 Carburettors having air or fuel-air mixture passage throttling valves other than of butterfly type** (register-type carburettors F02M 11/00); **Carburettors having fuel-air mixing chambers of variable shape or position**
- 9/02 • having throttling valves, e.g. of piston shape, slidably arranged transversely to the passage
- 9/04 • • with throttling valves sliding in a plane inclined to the passage
- 9/06 • • with means for varying cross-sectional area of fuel spray nozzle dependent on throttle position (F02M 7/17 takes precedence) [5]
- 9/08 • having throttling valves rotatably mounted in the passage
- 9/10 • having valves, or like controls, of elastic-wall type for controlling the passage, or for varying cross-sectional area, of fuel-air mixing chambers

- 9/12 • having other specific means for controlling the passage, or for varying cross-sectional area, of fuel-air mixing chambers
- 9/127 • • Axially movable throttle valves concentric with the axis of the mixture passage [5]
- 9/133 • • • the throttle valves having mushroom-shaped bodies [5]
- 9/14 • having venturi and nozzle relatively displaceable essentially along the venturi axis
- 11/00 Multi-stage carburetors; Register-type carburetors, i.e. with slidable or rotatable throttling valves in which a plurality of fuel nozzles, other than only an idling nozzle and a main one, are sequentially exposed to air stream by throttling valve**
- 11/02 • with throttling valve, e.g. of flap or butterfly type, in a later stage opening automatically
- 11/04 • • the later-stage valves having damping means
- 11/06 • Other carburetors with throttling valve of flap or butterfly type
- 11/08 • Register carburetors with throttling valve movable transversally to air passage
- 11/10 • Register carburetors with rotatable throttling valves
- 13/00 Arrangements of two or more separate carburetors (apparatus for testing, tuning, or synchronising carburetors F02M 19/01; re-atomising condensed fuel or homogenising fuel-air mixture F02M 29/00); Carburetors using more than one fuel (apparatus for adding small quantities of secondary fuel F02M 25/00)**
- 13/02 • Separate carburetors
- 13/04 • • structurally united
- 13/06 • the carburetors using different fuels
- 13/08 • Carburetors adapted to use liquid and gaseous fuels, e.g. alternatively
- 15/00 Carburetors with heating, cooling, or thermal insulating means for combustion-air, fuel, or fuel-air mixture (heating, cooling, or thermally insulating float apparatus F02M 5/00; apparatus for thermally treating combustion-air, fuel, or fuel-air mixture, not being part of a carburetor F02M 31/00)**
- 15/02 • with heating means, e.g. to combat ice-formation
- 15/04 • • the means being electrical
- 15/06 • Heat shieldings, e.g. from engine radiations
- 17/00 Carburetors having pertinent characteristics not provided for in, or of interest apart from, the apparatus of main groups F02M 1/00-F02M 15/00 (apparatus for treating combustion-air, fuel, or fuel-air mixture by catalysts, electric means, magnetism, rays, sonic waves, or the like F02M 27/00; combinations of carburetors and low-pressure fuel-injection apparatus F02M 71/00)**
- 17/02 • Floatless carburetors
- 17/04 • • having fuel inlet valve controlled by diaphragm
- 17/06 • • having overflow chamber determining constant fuel level
- 17/08 • Carburetors having one or more fuel passages opening in a valve-seat surrounding combustion-air passage, the valve being opened by passing air
- 17/09 • • the valve being of an eccentrically mounted butterfly type [5]
- 17/10 • Carburetors having one or more fuel passages opening in valve-member of air throttle
- 17/12 • • the valve-member being of butterfly type
- 17/14 • Carburetors with fuel-supply parts opened and closed in synchronism with engine stroke
- 17/16 • Carburetors having continuously-rotating bodies, e.g. surface carburetors (fuel injection by centrifugal forces F02M 69/06)
- 17/18 • Other surface carburetors
- 17/20 • • with fuel bath
- 17/22 • • • with air bubbling through bath
- 17/24 • • with wicks
- 17/26 • • with other wetted bodies
- 17/28 • • • fuel being drawn through a porous body
- 17/30 • Carburetors with fire-protecting devices, e.g. combined with fire-extinguishing apparatus
- 17/32 • • automatically closing fuel conduits on outbreak of fire
- 17/34 • Other carburetors combined or associated with other apparatus, e.g. air filters (predominant aspects of the apparatus, see the relevant classes for such apparatus)
- 17/36 • Carburetors having fitments facilitating their cleaning
- 17/38 • Controlling of carburetors, not otherwise provided for (external control gear F02M 19/12)
- 17/40 • Selection of particular materials for carburetors, e.g. sheet metal, plastic, or translucent materials
- 17/42 • Float-controlled carburetors not otherwise provided for
- 17/44 • Carburetors characterised by draught direction and not otherwise provided for
- 17/46 • • with down-draught
- 17/48 • • with up-draught
- 17/50 • Carburetors having means for combating ice-formation (thermally F02M 15/02)
- 17/52 • Use of cold, produced by carburetors, for other purposes (apparatus using the cold, see the relevant classes for such apparatus)
- 19/00 Details, component parts, or accessories of carburetors, not provided for in, or of interest apart from, the apparatus of groups F02M 1/00-F02M 17/00 (measuring or testing apparatus in general G01)**
- 19/01 • Apparatus for testing, tuning, or synchronising carburetors, e.g. carburetor flow stands [3]
- 19/02 • Metering-orifices, e.g. variable in diameter (variable during operation F02M 7/18)
- 19/025 • • Metering orifices not variable in diameter [4]
- 19/03 • Fuel atomising nozzles; Arrangement of emulsifying air conduits (atomising in general B05B) [4]
- 19/035 • • Mushroom-shaped atomising nozzles [4]
- 19/04 • Fuel-metering pins or needles
- 19/06 • Other details of fuel conduits
- 19/08 • Venturis
- 19/10 • • in multiple arrangement
- 19/12 • External control gear, e.g. having dash-pots (dampening means in later stages of multi-stage carburetors F02M 11/04; carburetor control gear in which the carburetor aspects do not predominate, see the relevant classes)
- 
- 21/00 Apparatus for supplying engines with non-liquid fuels, e.g. gaseous fuels stored in liquid form**
- 21/02 • for gaseous fuels (apparatus for vaporising liquid fuel by heat F02M 31/00; engines with apparatus generating gas from solid fuel, e.g. from wood, F02B 43/08)

- 21/04 • • Gas-air mixing apparatus (carburettors adapted to use liquid and gaseous fuels F02M 13/08; carburetting gases in general C10J)
- 21/06 • • Apparatus for de-liquefying, e.g. by heating (discharging liquefied gases in general F17C)
- 21/08 • for non-gaseous fuels (for engines operating on fuel containing oxidants F02B)
- 21/10 • • for fuels with low melting point, e.g. apparatus having heating means
- 21/12 • for fuels in pulverised state (engine plants with fuel-pulverising apparatus F02B)
- Engine-pertinent apparatus for feeding, or treating before their admission to engine, combustion-air, fuel, or fuel-air mixture**
- 23/00 Apparatus for adding secondary air to fuel-air mixture**
- 23/02 • with personal control
- 23/03 • • the secondary air-valve controlled by main combustion-air throttle [5]
- 23/04 • with automatic control
- 23/06 • • dependent on engine speed
- 23/08 • • dependent on pressure in main combustion-air induction system
- 23/09 • • • using valves directly opened by low pressure [6]
- 23/10 • • dependent on temperature, e.g. engine temperature
- 23/12 • characterised by being combined with device for, or by secondary air effecting, re-atomising of condensed fuel
- 23/14 • characterised by adding hot air
- 25/00 Engine-pertinent apparatus for adding non-fuel substances or small quantities of secondary fuel to combustion-air, main fuel, or fuel-air mixture** (F02M 43/00 takes precedence; adding secondary air to fuel-air mixture F02M 23/00)
- 25/022 • Adding fuel and water emulsion, water or steam [6]
- 25/025 • • Adding water [6]
- 25/028 • • • into the charge intakes [6]
- 25/03 • • • into the cylinders [6]
- 25/032 • • Producing and adding steam [6]
- 25/035 • • • into the charge intakes [6]
- 25/038 • • • into the cylinders [6]
- 25/06 • adding lubricant vapours or exhaust gases
- 25/07 • • adding exhaust gases [5]
- 25/08 • adding fuel vapours drawn from engine fuel reservoir
- 25/10 • adding acetylene, non-waterborne hydrogen, non-airborne oxygen, or ozone
- 25/12 • • the apparatus having means for generating such gases (using rays and simultaneously generating ozone F02M 27/06)
- 25/14 • adding anti-knock agents, not provided for in groups F02M 25/022-F02M 25/10
- 27/00 Apparatus for treating combustion-air, fuel, or fuel-air mixture, by catalysts, electric means, magnetism, rays, sonic waves, or the like**
- 27/02 • by catalysts
- 27/04 • by electric means or magnetism
- 27/06 • by rays
- 27/08 • by sonic or ultrasonic waves
- 29/00 Apparatus for re-atomising condensed fuel or homogenising fuel-air mixture** (combined with secondary-air supply F02M 23/12)
- 29/02 • having rotary parts
- 29/04 • having screens, gratings, baffles, or the like (rotary F02M 29/02)
- 29/06 • • generating whirling motion of mixture
- 29/08 • • having spirally-wound wires
- 29/10 • • adjustable
- 29/12 • having homogenising valves held open by mixture current
- 29/14 • re-atomising or homogenising being effected by unevenness of internal surfaces of mixture intake
- 31/00 Apparatus for thermally treating combustion-air, fuel, or fuel-air mixture** (F02M 21/06, F02M 21/10 take precedence; such apparatus being part of a carburettor or fuel-injection apparatus F02M 15/00, F02M 53/00; adding hot secondary air to fuel-air mixture F02M 23/14)
- 31/02 • for heating
- 31/04 • • combustion-air or fuel-air mixture (electrically F02M 31/12; by using heat from working cylinders or cylinder heads F02M 31/14; heating of combustion-air as an engine starting aid F02N 19/04) [4]
- 31/06 • • • by hot gases, e.g. by mixing cold and hot air
- 31/07 • • • • Temperature-responsive control, e.g. using thermostatically-controlled valves (F02M 31/083 takes precedence) [6]
- 31/08 • • • • the gases being exhaust gases
- 31/083 • • • • • Temperature-responsive control of the amount of exhaust gas or combustion air directed to the heat exchange surface [6]
- 31/087 • • • • • Heat-exchange arrangements between the air intake and exhaust gas passages, e.g. by means of contact between the passages [5]
- 31/093 • • • • • • Air intake passage surrounding the exhaust gas passage; Exhaust gas passage surrounding the air intake passage [5]
- 31/10 • • • • by hot liquids, e.g. lubricants
- 31/12 • • electrically
- 31/125 • • • Fuel [5]
- 31/13 • • • Combustion air [5]
- 31/135 • • • Fuel-air mixture [5]
- 31/14 • • by using heat from working cylinders or cylinder heads
- 31/16 • • Other apparatus for heating fuel
- 31/18 • • • to vaporise fuel
- 31/20 • for cooling (cooling of charging-air or of scavenging-air F02B)
- 33/00 Other apparatus for treating combustion-air, fuel or fuel-air mixture** (combustion-air cleaners F02M 35/00; arrangements for purifying liquid fuel F02M 37/22)
- 33/02 • for collecting and returning condensed fuel
- 33/04 • • returning to the intake passage [5]
- 33/06 • • • with simultaneous heat supply [5]
- 33/08 • • returning to the fuel tank [5]
- 35/00 Combustion-air cleaners, air intakes, intake silencers, or induction systems specially adapted for, or arranged on, internal-combustion engines** (air cleaners in general B01D)
- 35/02 • Air cleaners
- 35/022 • • acting by gravity, by centrifugal, or by other inertial forces, e.g. with moistened walls [2]

## F02M

- 35/024 • • using filters, e.g. moistened (F02M 35/026 takes precedence; cleaning of the filtering material F02M 35/08) [2]
- 35/026 • • acting by guiding the air over or through an oil or other liquid bath, e.g. combined with filters [2]
- 35/04 • • specially arranged with respect to engine; Mounting thereon
- 35/06 • • • combined or associated with engine's cooling blower or fan, or with flywheel
- 35/08 • • with means for removing dust from cleaners; with means for indicating clogging; with by-pass means
- 35/09 • • • Clogging indicators [6]
- 35/10 • Air intakes; Induction systems (using kinetic or wave energy of charge in induction systems for improving quantity of charge F02B)
- 35/104 • • Intake manifolds [6]
- 35/108 • • • with primary and secondary intake passages [6]
- 35/112 • • • for engines with cylinders all in one line (F02M 35/108 takes precedence) [6]
- 35/116 • • • for engines with cylinders in V-arrangement or arranged oppositely relative to the main shaft (F02M 35/108 takes precedence) [6]
- 35/12 • Intake silencers
- 35/14 • Combined air cleaners and silencers
- 35/16 • characterised by use in vehicles (predominant vehicle aspects, see the relevant classes for the vehicles)
- 37/00 Apparatus or systems for feeding liquid fuel from storage containers to carburettors or fuel-injection apparatus** (F02M 69/00 takes precedence; feeding liquid fuel to combustion apparatus, in general F23K 5/00; fuel supply to apparatus for generating combustion products of high pressure or high velocity F23R 3/28); **Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines** (separating apparatus, filters per se B01D; centrifuges B04B) [5]
- 37/02 • Feeding by means of suction apparatus, e.g. by air flow through carburettors (by driven pumps F02M 37/04)
- 37/04 • Feeding by means of driven pumps (pump construction F04)
- 37/06 • • mechanically driven
- 37/08 • • electrically driven
- 37/10 • • • submerged in fuel, e.g. in reservoir
- 37/12 • • fluid-driven, e.g. by compressed combustion-air
- 37/14 • • the pumps being combined with other apparatus
- 37/16 • • characterised by provision of personally-, e.g. manually-, operated pumps
- 37/18 • • characterised by provision of main and auxiliary pumps
- 37/20 • characterised by means for preventing vapour lock
- 37/22 • Arrangements for purifying liquid fuel specially adapted for, or arranged on, internal-combustion engines, e.g. arrangement in the feeding system [3]

### Fuel-injection apparatus

#### Note(s) [2009.01]

Low-pressure fuel injection is classified in groups F02M 51/00, F02M 69/00 or F02M 71/00.

- 39/00 Arrangements of fuel-injection apparatus with respect to engines; Pump drives adapted to such arrangements** (F02M 49/00 takes precedence; arrangements of injectors F02M 61/14)

- 39/02 • Arrangements of fuel-injection apparatus to facilitate the driving of pumps; Arrangements of fuel-injection pumps; Pump drives
- 41/00 Fuel-injection apparatus with two or more injectors fed from a common pressure-source sequentially by means of a distributor**
- 41/02 • the distributor being spaced from pumping elements
- 41/04 • • the distributor reciprocating
- 41/06 • • the distributor rotating
- 41/08 • the distributor and pumping elements being combined
- 41/10 • • pump pistons acting as the distributor
- 41/12 • • • the pistons rotating to act as the distributor
- 41/14 • • rotary distributor supporting pump pistons
- 41/16 • characterised by the distributor being fed from a constant-pressure source, e.g. accumulator
- 43/00 Fuel-injection apparatus operating simultaneously on two or more fuels or on a liquid fuel and another liquid, e.g. the other liquid being an anti-knock additive**
- 43/02 • Pumps peculiar thereto
- 43/04 • Injectors peculiar thereto
- 45/00 Fuel-injection apparatus characterised by having a cyclic delivery of specific time/pressure or time/quantity relationship** (fuel injectors having such deliveries by means of valves furnished at seated ends with pintle- or plug-shaped extensions F02M 61/06)
- 45/02 • with each cyclic delivery being separated into two or more parts
- 45/04 • • with a small initial part
- 45/06 • • • Pumps peculiar thereto
- 45/08 • • • Injectors peculiar thereto
- 45/10 • • Other injectors with multiple-part delivery, e.g. with vibrating valves
- 45/12 • providing a continuous delivery with variable pressure
- 47/00 Fuel-injection apparatus operated cyclically with fuel-injection valves actuated by fluid pressure** (F02M 49/00 takes precedence; apparatus with injection valves opened by fuel pressure and closed by non-fluid means, see the groups providing for other characteristics)
- 47/02 • of accumulator-injector type, i.e. having fuel pressure of accumulator tending to open, and fuel pressure in other chamber tending to close, injection valves, and having means for periodically releasing that closing pressure
- 47/04 • using fluid, other than fuel, for injection-valve actuation
- 47/06 • Other fuel injectors peculiar thereto
- 49/00 Fuel-injection apparatus in which injection pumps are driven, or injectors are actuated, by the pressure in engine working cylinders, or by impact of engine working piston**
- 49/02 • using the cylinder pressure, e.g. compression end pressure
- 49/04 • using the piston impact
- 51/00 Fuel-injection apparatus characterised by being operated electrically**
- 51/02 • specially for low-pressure fuel-injection (pumps per se F02M 51/04; injectors per se F02M 51/08)
- 51/04 • Pumps peculiar thereto

- 51/06 • Injectors peculiar thereto  
51/08 • • specially for low-pressure fuel-injection
- 53/00 Fuel-injection apparatus characterised by having heating, cooling, or thermally-insulating means**
- 53/02 • with fuel-heating means, e.g. for vaporising  
53/04 • Injectors with heating, cooling, or thermally-insulating means  
53/06 • • with fuel-heating means, e.g. for vaporising  
53/08 • • with air cooling
- 55/00 Fuel-injection apparatus characterised by their fuel conduits or their venting means**
- 55/02 • Conduits between injection pumps and injectors  
55/04 • Means for damping vibrations in injection-pump inlets
- 57/00 Fuel injectors combined or associated with other devices**
- 57/02 • Injectors structurally combined with fuel-injection pumps  
57/04 • the devices being combustion-air intake or exhaust valves  
57/06 • the devices being sparking-plugs
- 59/00 Pumps specially adapted for fuel-injection and not provided for in groups F02M 39/00-F02M 57/00 (general features of pumps F04)**
- 59/02 • of reciprocating-piston type  
59/04 • • characterised by special arrangement of cylinders with respect to piston-driving shaft, e.g. arranged parallel to that shaft  
59/06 • • • with cylinders arranged radially to driving shaft, e.g. in V- or star-arrangement  
59/08 • • characterised by two or more pumping elements with conjoint outlet  
59/10 • • characterised by the piston drive  
59/12 • having other positive-displacement pumping elements, e.g. rotary  
59/14 • • of elastic-wall type  
59/16 • characterised by having multi-stage compression of fuel  
59/18 • characterised by the pumping action being achieved through release of pre-compressed springs  
59/20 • Varying fuel delivery in quantity or timing  
59/22 • • Varying quantity by adjusting cylinder-head space  
59/24 • • with constant-length-stroke pistons having variable effective portion of stroke  
59/26 • • • caused by movements of pistons relative to their cylinders  
59/28 • • • • Mechanisms therefor  
59/30 • • with variable-length-stroke pistons  
59/32 • • fuel delivery being controlled by means of fuel-displaced auxiliary pistons, which effect injection  
59/34 • • by throttling of passages to pumping elements or of overflow passages  
59/36 • • by variably-timed valves controlling fuel passages  
59/38 • Pumps characterised by adaptations to special uses or conditions  
59/40 • • for reversible engines  
59/42 • • for starting of engines  
59/44 • Details, component parts, or accessories not provided for in, or of interest apart from, the apparatus of groups F02M 59/02-F02M 59/42  
59/46 • • Valves (in general F16K)  
59/48 • • Assembling; Disassembling; Replacing
- 61/00 Fuel injectors not provided for in groups F02M 39/00-F02M 57/00 or F02M 67/00**
- 61/02 • of valveless type  
61/04 • having valves (valves in general F16K)  
61/06 • • the valves being furnished at seated ends with pintle- or plug-shaped extensions  
61/08 • • the valves opening in direction of fuel flow  
61/10 • • Other injectors with elongated valve bodies, i.e. of needle-valve type  
61/12 • • • characterised by the provision of guiding or centring means for valve bodies  
61/14 • Arrangements of injectors with respect to engines; Mounting of injectors  
61/16 • Details not provided for in, or of interest apart from, the apparatus of groups F02M 61/02-F02M 61/14  
61/18 • • Injection nozzles, e.g. having valve-seats  
61/20 • • Closing valves mechanically, e.g. arrangements of springs or weights
- 63/00 Other fuel-injection apparatus having pertinent characteristics not provided for in groups F02M 39/00-F02M 57/00 or F02M 67/00; Details, component parts or accessories of fuel-injection apparatus, not provided for in, or of interest apart from, the apparatus of groups F02M 39/00-F02M 61/00 or F02M 67/00**
- 63/02 • Fuel-injection apparatus having several injectors fed by a common pumping element, or having several pumping elements feeding a common injector; Fuel-injection apparatus having provisions for cutting-out pumps, pumping elements, or injectors; Fuel-injection apparatus having provisions for variably interconnecting pumping elements and injectors alternatively  
63/04 • Fuel-injection apparatus having injection valves held closed by a cyclically-operated mechanism for a time and automatically opened by fuel pressure, e.g. of constant-pressure pump or accumulator, when that mechanism releases the valve  
63/06 • Use of pressure wave generated by fuel inertia to open injection valves
- 65/00 Testing fuel-injection apparatus, e.g. testing injection timing**
- 
- 67/00 Apparatus in which fuel-injection is effected by means of high-pressure gas, the gas carrying the fuel into working cylinders of the engine, e.g. air-injection type (using compressed air for low-pressure fuel-injection apparatus F02M 69/08)**
- 67/02 • the gas being compressed air, e.g. compressed in pumps (arrangements or adaptations of such pumps F02B)  
67/04 • • the air being extracted from working cylinders of the engine  
67/06 • the gas being other than air, e.g. steam, combustion gas  
67/08 • • the gas being generated by combustion of part of fuel other than in engine working cylinders  
67/10 • Injectors peculiar thereto, e.g. of valveless type  
67/12 • • having valves  
67/14 • characterised by provisions for injecting different fuels, e.g. main fuel and readily self-igniting starting-fuel
- 69/00 Low-pressure fuel-injection apparatus (electrically-operated F02M 51/00)**

## F02M

- 69/02 • Pumps peculiar thereto
- 69/04 • Injectors peculiar thereto
- 69/06 • characterised by the pressurisation of the fuel being caused by centrifugal force acting on the fuel
- 69/08 • characterised by the fuel being carried by compressed air into main stream of combustion-air
- 69/10 • peculiar to scavenged two-stroke engines, e.g. injecting into crankcase-pump chamber
- 69/12 • comprising a fuel-displaced free piston for intermittently metering and supplying fuel to injection nozzles [5]
- 69/14 • having cyclically-operated valves connecting injection nozzles to a source of fuel under pressure during the injection period [5]
- 69/16 • characterised by means for metering continuous fuel flow to injectors or means for varying fuel pressure upstream of injectors [5]
- 69/18 • • the means being metering valves throttling fuel passages to injectors or by-pass valves throttling overflow passages, the metering valves being actuated by a device responsive to the engine working parameters, e.g. engine load, speed, temperature or quantity of air (F02M 69/26 takes precedence) [5]
- 69/20 • • • the device being a servo-motor, e.g. using engine intake air pressure or vacuum (F02M 69/22 takes precedence) [5]
- 69/22 • • • the device comprising a member movably mounted in the air intake conduit and displaced according to the quantity of air admitted to the engine [5]
- 69/24 • • • the device comprising a member for transmitting the movement of the air throttle valve actuated by the operator to the valves controlling fuel passages [5]
- 69/26 • • the means varying fuel pressure in a fuel by-pass passage, the pressure acting on a throttle valve against the action of metered or throttled fuel pressure for variably throttling fuel flow to injection nozzles, e.g. to keep constant the pressure differential at the metering valve [5]
- 69/28 • characterised by means for cutting-out the fuel supply to the engine or to main injectors during certain operating periods, e.g. deceleration [5]
- 69/30 • characterised by means for facilitating the starting-up or idling of engines or by means for enriching fuel charge, e.g. below operational temperatures or upon high power demand of engines (at acceleration F02M 69/44) [5]
- 69/32 • • with an air by-pass around the air throttle valve or with an auxiliary air passage, e.g. with a variably controlled valve therein [5]
- 69/34 • • with an auxiliary fuel circuit supplying fuel to the engine, e.g. with the fuel pump outlet being directly connected to the injection nozzles [5]
- 69/36 • • having an enrichment mechanism modifying fuel flow to injectors, e.g. by acting on the fuel metering device or on the valves throttling fuel passages to injection nozzles or overflow passages [5]
- 69/38 • • • using fuel pressure, e.g. by varying fuel pressure in the control chambers of the fuel metering device (F02M 69/26 takes precedence) [5]
- 69/40 • • • using variably controlled air pressure, e.g. by modifying the intake air vacuum signal acting on the fuel metering device [5]
- 69/42 • • • using other means than variable fluid pressure, e.g. acting on the fuel metering device mechanically or electrically [5]
- 69/44 • characterised by means for supplying extra fuel to the engine on sudden air throttle opening, e.g. at acceleration [5]
- 69/46 • Details, component parts or accessories not provided for in, or of interest apart from, the apparatus covered by groups F02M 69/02-F02M 69/44 [5]
- 69/48 • • Arrangement of air sensors [5]
- 69/50 • • Arrangement of fuel distributors [5]
- 69/52 • • Arrangement of fuel metering devices [5]
- 69/54 • • Arrangement of fuel pressure regulators [5]
- 71/00 Combinations of carburettors and low-pressure fuel-injection apparatus** (means for enriching charge on sudden air throttle opening of carburettors F02M 7/06)
- 71/02 • with fuel-air mixture being produced by the carburettor and being compressed by a pump for subsequent injection into main combustion-air (adaptations or arrangements of such pumps F02B)
- 71/04 • with carburettor being used at starting or idling only and injection apparatus being used during normal operation of engine
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**

**F02N STARTING OF COMBUSTION ENGINES** (starting of free-piston combustion-engines F02B 71/02; starting of gas-turbine plants F02C 7/26); **STARTING AIDS FOR SUCH ENGINES, NOT OTHERWISE PROVIDED FOR**

### Note(s)

1. Attention is drawn to the Notes preceding class F01.
2. The starting of engines which are not explicitly stated to be combustion engines is classified in this subclass in so far as their starting is equivalent to that of combustion engines.

### Subclass index

STARTING BY MUSCLE POWER.....	1/00, 3/00, 5/00
STARTING OTHERWISE	
With mechanical energy storage.....	5/00
By fluid motor; by electric motor.....	7/00, 11/00
By direct action in the working chamber: by fluid pressure; by explosives.....	9/00, 13/00
By other apparatus, details, accessories.....	15/00

OTHER MEANS OR AIDS FOR STARTING.....19/00, 99/00

**Muscle-operated starting apparatus**

- 1/00 Starting apparatus having hand cranks** (with intermediate power storage F02N 5/00-F02N 15/00)
- 1/02 • having safety means preventing damage caused by reverse rotation
- 3/00 Other muscle-operated starting apparatus** (with intermediate power storage F02N 5/00-F02N 15/00)
- 3/02 • having pull-cords
- 3/04 • having foot-actuated levers

- 11/02 • the motors having longitudinally-shiftable rotors
- 11/04 • the motors being associated with current generators
- 11/06 • • and with ignition apparatus
- 11/08 • Circuits specially adapted for starting of engines
- 11/10 • Safety devices (F02N 11/08 takes precedence)
- 11/12 • Starting of engines by means of mobile, e.g. portable, starting sets
- 11/14 • Starting of engines by means of electric starters with external current supply (F02N 11/12 takes precedence)

**Power-operated starting apparatus; Muscle-operated starting apparatus with intermediate power storage**

- 5/00 Starting apparatus having mechanical power storage**
- 5/02 • of spring type
- 5/04 • of inertia type
- 7/00 Starting apparatus having fluid-driven auxiliary engines or apparatus**
- 7/02 • the apparatus being of single-stroke piston type, e.g. pistons acting on racks or pull-cords
- 7/04 • • the pistons acting on screw-threaded members to effect rotation
- 7/06 • the engines being of reciprocating-piston type (of internal-combustion type F02N 7/10)
- 7/08 • the engines being of rotary type
- 7/10 • characterised by using auxiliary engines or apparatus of combustion type (by using explosive cartridges F02N 13/00)
- 7/12 • • the engines being of rotary type, e.g. turbines (F02N 7/14 takes precedence)
- 7/14 • • the starting engines being readily removable from main engines, e.g. of portable type
- 9/00 Starting of engines by supplying auxiliary pressure fluid to their working chambers**
- 9/02 • the pressure fluid being generated directly by combustion (by using explosive cartridges F02N 13/00)
- 9/04 • the pressure fluid being generated otherwise, e.g. by compressing air
- 11/00 Starting of engines by means of electric motors** (arrangement or mounting of prime-movers consisting of electric motors and internal combustion engines for mutual or common propulsion B60K 6/20)

- 13/00 Starting of engines, or driving of starting apparatus by use of explosives, e.g. stored in cartridges**
- 13/02 • Cartridges specially adapted therefor (gas cartridges in general F42B 3/04)
- 15/00 Other power-operated starting apparatus; Component parts, details, or accessories, not provided for in, or of interest apart from, groups F02N 5/00-F02N 13/00**
- 15/02 • Gearing between starting-engines and started engines; Engagement or disengagement thereof
- 15/04 • • the gearing including disengaging toothed gears
- 15/06 • • • the toothed gears being moved by axial displacement
- 15/08 • • the gearing being of friction type
- 15/10 • Safety devices not otherwise provided for

- 19/00 Starting aids for combustion engines, not otherwise provided for [2010.01]**
- 19/02 • Aiding engine start by thermal means, e.g. using lighted wicks (using electrically-heated glowing plugs F02P 19/02) [2010.01]
- 19/04 • • by heating of fluids used in engines (heating of lubricants F01M 5/02) [2010.01]
- 19/06 • • • by heating of combustion-air by flame generating means, e.g. flame glow-plugs [2010.01]
- 19/08 • • • • Arrangement thereof [2010.01]
- 19/10 • • • by heating of engine coolants [2010.01]
- 99/00 Subject matter not provided for in the other groups of this subclass [2010.01]**

**F02P IGNITION, OTHER THAN COMPRESSION IGNITION, FOR INTERNAL-COMBUSTION ENGINES; TESTING OF IGNITION TIMING IN COMPRESSION-IGNITION ENGINES** (specially adapted for rotary-piston or oscillating-piston engines F02B 53/12; ignition of combustion apparatus in general, glowing plugs F23Q; measuring of physical variables in general G01; controlling in general G05; data processing in general G06; electrical components in general, see section H; sparking plugs H01T)

**Subclass index****ELECTRIC SPARK IGNITION**

- Directly from generator; other installations.....1/00, 3/00
- Sparking plugs structurally combined with engine parts.....13/00
- Control: timing, distributing; other.....5/00, 7/00, 9/00
- Safety means.....11/00

Other features.....	15/00
Testing.....	17/00
IGNITION OTHERWISE THAN BY ELECTRIC SPARK: BY INCANDESCENCE; BY DIRECT FLAME; BY OTHER MEANS.....	19/00, 21/00, 23/00

### Electric spark ignition installations characterised by the type of ignition power generation or storage

<b>1/00 Installations having electric ignition energy generated by magneto- or dynamo-electric generators without subsequent storage</b>	5/12	• • • dependent on a specific pressure other than that of combustion-air, e.g. of exhaust, cooling fluid, lubricant [4]
1/02 • the generator rotor being characterised by forming part of the engine flywheel	5/14	• • • dependent on specific conditions other than engine speed or engine fluid pressure, e.g. temperature [4]
1/04 • the generator being specially adapted for use with specific engine types, e.g. engines with V-arrangement of cylinders	5/145	• • using electrical means [4]
1/06 • Generator drives, e.g. having snap couplings	5/15	• • • Digital data processing [4]
1/08 • Layout of circuits	5/152	• • • dependent on pinking (detecting or indicating knocks in internal-combustion engines G01L 23/22) [6]
<b>3/00 Other electric spark ignition installations characterised by the type of ignition power generation storage</b>	5/153	• • • dependent on combustion pressure [6]
3/01 • Electric spark ignition installations without subsequent energy storage, i.e. energy supplied by an electrical oscillator (with magneto- or dynamo-electric generators F02P 1/00; piezo-electric ignition F02P 3/12; with continuous electric spark F02P 15/10) [4]	5/155	• • • Analogue data processing [4]
3/02 • having inductive energy storage, e.g. arrangements of induction coils	5/16	• characterised by the mechanical transmission between sensing elements or personal controls and final actuating elements
3/04 • • Layout of circuits	<b>7/00 Arrangement of distributors, circuit-makers, circuit-breakers or pick-up devices for electric spark ignition</b> (advancing or retarding ignition or control therefor F02P 5/00; such devices <i>per se</i> , <i>see</i> the relevant classes of section H, e.g. rotary switches H01H 19/00, contact-breakers, distributors H01R 39/00, generators H02K)	
3/045 • • • for control of the dwell or anti-dwell time [4]	7/02	• of distributors
3/05 • • • for control of the magnitude of the current in the ignition coil (during starting F02P 15/12) [4]	7/03	• • with electrical means (ignition occurring simultaneously at different places in one engine cylinder or in two or more separate engine cylinders F02P 15/08) [4]
3/055 • • • with protective means to prevent damage to the circuit or the ignition coil [4]	7/04	• • having distributors with air-tight casing
3/06 • having capacitive energy storage (piezo-electric or electrostatic ignition F02P 3/12)	7/06	• of circuit-makers or -breakers, or pick-up devices adapted to sense particular points of the timing cycle [4]
3/08 • • Layout of circuits (for low tension F02P 3/10)	7/063	• • Mechanical pick-up devices, circuit-makers or -breakers, e.g. contact-breakers [4]
3/09 • • • for control of the charging current in the capacitor (F02P 15/12 takes precedence) [4]	7/067	• • Electromagnetic pick-up devices [4]
3/10 • • Low-tension installation, e.g. using surface-discharge sparking plugs	7/07	• • • Hall-effect pick-up devices [4]
3/12 • Piezo-electric ignition; Electrostatic ignition	7/073	• • Optical pick-up devices [4]
	7/077	• • Circuits therefor, e.g. pulse generators [4]
	7/08	• • having air-tight casings
	7/10	• Drives of distributors or of circuit-makers or -breakers

### Advancing or retarding electric ignition spark; Arrangements of distributors or of circuit-makers or -breakers for electric spark ignition; Electric spark ignition control or safety means, not otherwise provided for

<b>5/00 Advancing or retarding electric ignition spark; Control therefor [6]</b>	<b>9/00 Electric spark ignition control, not otherwise provided for</b>
5/02 • non-automatically; dependent on position of personal controls of engine, e.g. throttle position	<b>11/00 Safety means for electric spark ignition, not otherwise provided for</b>
5/04 • automatically, as a function of the working conditions of the engine or vehicle or of the atmospheric conditions (dependent on position of personal controls of engine F02P 5/02)	11/02 • Preventing damage to engines or engine-driven gearing
5/05 • • using mechanical means [4]	11/04 • Preventing unauthorised use of engines (of vehicles B60R 25/04; ignition locks H01H 27/00)
5/06 • • • dependent on engine speed [4]	11/06 • Indicating unsafe conditions
5/07 • • • Centrifugal timing mechanisms [6]	
5/10 • • • dependent on fluid pressure in engine, e.g. combustion-air pressure [4]	<b>13/00 Sparking plugs structurally combined with other parts of internal-combustion engines</b> (with fuel injectors F02M 57/06; predominant aspects of the parts, <i>see</i> the relevant subclasses)

- 15/00 Electric spark ignition having characteristics not provided for in, or of interest apart from, groups F02P 1/00-F02P 13/00**
- 15/02 • Arrangements having two or more sparking plugs
  - 15/04 • one of the spark electrodes being mounted on the engine working piston
  - 15/06 • the electric spark triggered by engine working cylinder compression
  - 15/08 • having multiple-spark ignition, i.e. ignition occurring simultaneously at different places in one engine cylinder or in two or more separate engine cylinders
  - 15/10 • having continuous electric sparks
  - 15/12 • having means for strengthening spark during starting
- 17/00 Testing of ignition installations, e.g. in combination with adjusting** (testing fuel injection apparatus F02M 65/00; testing ignition installations in general F23Q 23/00); **Testing of ignition timing in compression-ignition engines [4]**
- 17/02 • Checking or adjusting ignition timing [6]
  - 17/04 • • dynamically [6]
  - 17/06 • • • using a stroboscopic lamp [6]
  - 17/08 • • • using a cathode-ray oscilloscope (F02P 17/06 takes precedence) [6]
  - 17/10 • Measuring dwell or antidwell time [6]
- 17/12 • Testing characteristics of the spark, ignition voltage or current [6]
- Other ignition**
- 19/00 Incandescent ignition, e.g. during starting of internal-combustion engines; Combination of incandescent and spark ignition [4]**
- 19/02 • electric, e.g. layout of circuits of apparatus having glowing plugs
  - 19/04 • non-electric, e.g. heating incandescent spots by burners (use of burners for direct ignition F02P 21/00)
- 21/00 Direct use of flames or burners for ignition**
- 21/02 • the flames being kept burning essentially external to engine working chambers
  - 21/04 • Burning-cartridges or like inserts being arranged in engine working chambers (as starting aid F02N 19/02)
- 23/00 Other ignition**
- 23/02 • Friction, pyrophoric, or catalytic ignition
  - 23/04 • Other physical ignition means, e.g. using laser rays

## F03 MACHINES OR ENGINES FOR LIQUIDS; WIND, SPRING, OR WEIGHT MOTORS; PRODUCING MECHANICAL POWER OR A REACTIVE PROPULSIVE THRUST, NOT OTHERWISE PROVIDED FOR

**F03B MACHINES OR ENGINES FOR LIQUIDS** (machines or engines for liquids and elastic fluids F01; positive-displacement engines for liquids F03C; positive-displacement machines for liquids F04)

### Note(s)

1. This subclass covers:
  - engines, other than of positive-displacement type, driven by liquids;
  - machines, other than of positive-displacement type, for liquids.
2. Attention is drawn to the Notes preceding class F01, especially as regards the definition of "reaction type".

### Subclass index

TURBINES: IMPULSE; REACTION.....	1/00, 3/00
MACHINES OR ENGINES: NON-BLADED ROTOR TYPE; WATER WHEELS; ENDLESS-CHAIN TYPE.....	5/00, 7/00, 9/00
PARTS OR DETAILS OF ABOVE KINDS.....	1/00, 3/00, 11/00
ADAPTATIONS OR COMBINATIONS.....	13/00
CONTROLLING.....	15/00
OTHER MACHINES OR ENGINES.....	17/00

- 1/00 Engines of impulse type, i.e. turbines with jets of high-velocity liquid impinging on bladed or like rotors, e.g. Pelton wheels; Parts or details peculiar thereto**
- 1/02 • Buckets; Bucket-carrying rotors
  - 1/04 • Nozzles (in general B05B); Nozzle-carrying members
- 3/00 Machines or engines of reaction type; Parts or details peculiar thereto**
- 3/02 • with radial flow at high-pressure side and axial flow at low-pressure side of rotors, e.g. Francis turbines
- 3/04 • with substantially axial flow throughout rotors, e.g. propeller turbines
- 3/06 • • with adjustable blades, e.g. Kaplan turbines
- 3/08 • with pressure/velocity transformation exclusively in rotors
- 3/10 • characterised by having means for functioning alternatively as pumps or turbines
- 3/12 • Blades; Blade-carrying rotors
- 3/14 • • Rotors having adjustable blades
- 3/16 • Stators
- 3/18 • • Stator blades; Guide conduits or vanes, e.g. adjustable

**F03B**

5/00	<b>Machines or engines characterised by non-bladed rotors, e.g. serrated, using friction</b>	13/18	• • • • wherein the other member is fixed, at least at one point, with respect to the sea bed or shore [4]
7/00	<b>Water wheels</b>	13/20	• • • • wherein both members are movable relative to the sea bed or shore [4]
9/00	<b>Endless-chain type machines or engines</b>	13/22	• • • using the flow of water resulting from wave movements, e.g. to drive a hydraulic motor or turbine [4]
11/00	<b>Parts or details not provided for in, or of interest apart from, groups F03B 1/00-F03B 9/00</b> (controlling F03B 15/00)	13/24	• • • to produce a flow of air, e.g. to drive an air turbine [4]
11/02	• Casings	13/26	• • using tide energy [4]
11/04	• for diminishing cavitation or vibration, e.g. balancing		
11/06	• Bearing arrangements		
11/08	• for removing foreign matter, e.g. mud		
13/00	<b>Adaptations of machines or engines for special use; Combinations of machines or engines with driving or driven apparatus</b> (if the apparatus aspects are predominant, <u>see</u> the relevant places for such apparatus, e.g. H02K 7/18); <b>Power stations or aggregates</b> (hydraulic-engineering aspects E02B; incorporating only machines or engines of positive-displacement type F03C)	15/00	<b>Controlling</b> (controlling in general G05)
13/02	• Adaptations for drilling wells	15/02	• by varying liquid flow
13/04	• Adaptations for use in dentistry	15/04	• • of turbines (rotors having adjustable blades F03B 3/06, F03B 3/14; adjustable guide vanes F03B 3/18; specially adapted for turbines with jets of high-velocity liquid impinging on bladed or like rotors F03B 15/20)
13/06	• Stations or aggregates of water-storage type (turbines characterised by having means for functioning alternatively as pumps F03B 3/10)	15/06	• • • Regulating, i.e. acting automatically
13/08	• Machine or engine aggregates in dams or the like; Conduits therefor	15/08	• • • • by speed, e.g. by measuring electric frequency or liquid flow
13/10	• Submerged units incorporating electric generators or motors	15/10	• • • • • without retroactive action
13/12	• characterised by using wave or tide energy	15/12	• • • • • with retroactive action
13/14	• • using wave energy [4]	15/14	• • • • by or of water level
13/16	• • • using the relative movement between a wave-operated member and another member [4]	15/16	• • • • by power output
		15/18	• • • • for safety purposes, e.g. preventing overspeed
		15/20	• • specially adapted for turbines with jets of high-velocity liquid impinging on bladed or like rotors (nozzles F03B 1/04)
		15/22	• • • for safety purposes
		17/00	<b>Other machines or engines</b>
		17/02	• using hydrostatic thrust
		17/04	• • Alleged <u>perpetua mobilia</u>
		17/06	• using liquid flow, e.g. of swinging-flap type

**F03C POSITIVE-DISPLACEMENT ENGINES DRIVEN BY LIQUIDS** (positive-displacement engines for liquids and elastic fluids F01; positive-displacement machines for liquids F04; fluid-pressure actuators F15B; fluid gearing F16H)

**Note(s)**

Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "positive displacement", "rotary-piston machines", "oscillating-piston machines", "rotary-piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents", and "internal axis".

1/00	<b>Reciprocating-piston liquid engines</b>	1/08	• Distributing valve-gear peculiar thereto (for multiple-cylinder engines F03C 1/34; for engines with positive displacement in general F01L)
1/007	• with single cylinder, double-acting piston [5]	1/10	• • actuated by piston or piston-rod
1/013	• with single cylinder, single-acting piston [5]	1/12	• • • mechanically [5]
1/02	• with multiple cylinders, characterised by the number or arrangement of cylinders (with movable cylinders F03C 1/22; of flexible-wall type F03C 7/00)	1/14	• • actuated by the driving liquid of the engine [5]
1/03	• • with movement in two directions being obtained by two single-acting piston liquid engines, each acting in one direction [5]	1/16	• • Speed controlling, equalising, or cushioning [5]
1/04	• • with cylinders in star- or fan-arrangement	1/20	• • specially adapted for engines generating vibration only
1/047	• • • the pistons co-operating with an actuated element at the outer ends of the cylinders [5]	1/22	• with movable cylinders
1/053	• • • the pistons co-operating with an actuated element at the inner ends of the cylinders [5]	1/24	• • in which the liquid exclusively displaces one or more pistons reciprocating in rotary cylinders
1/06	• • with cylinder axes generally coaxial with, or parallel or inclined to, main shaft axis	1/247	• • • with cylinders in star- or fan-arrangement [5]
		1/253	• • • with cylinder axes generally coaxial with, or parallel to, main shaft axis [5]

- 1/26 • adapted for special use or combined with apparatus driven thereby (aspects predominantly concerning the driven apparatus, see the relevant classes for such apparatus)
- 1/28 • Pistons specially adapted therefor [5]
- 1/30 • Cams specially adapted therefor [5]
- 1/32 • Cylinders specially adapted therefor [5]
- 1/34 • Distribution members specially adapted for multiple-cylinder engines [5]
- 1/36 • • Cylindrical distribution members [5]
- 1/38 • • Plate-like distribution members [5]
- 1/40 • Control specially adapted therefor [5]
- 2/00 Rotary-piston engines** (in which the liquid exclusively displaces one or more piston reciprocating in rotary cylinders F03C 1/24) [3]
 

**Note(s)**

Group F03C 2/30 takes precedence over groups F03C 2/02-F03C 2/24.
- 2/02 • 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 [3]
- 2/08 • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3]
- 2/22 • 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 [3]
- 2/24 • of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3]
- 2/30 • having the characteristics covered by two or more of groups F03C 2/02, F03C 2/08, F03C 2/22, F03C 2/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members [3]
- 4/00 Oscillating-piston engines** [3]
- 7/00 Engines of flexible-wall type** [2010.01]
- 99/00 Subject matter not provided for in other groups of this subclass** [2010.01]

## F03D WIND MOTORS

### Note(s)

1. This subclass covers wind motors, i.e. mechanisms for converting the energy of natural wind into useful mechanical power, and the transmission of such power to its point of use.
  2. This subclass does not cover electrical power generation or distribution aspects of wind-power plants, which are covered by section H, e.g. H02J or H02P.
  3. In this subclass, the following terms or expressions are used with the meanings indicated:
    - "rotor" means the wind-engaging parts of the wind motor and the rotary member carrying them;
    - "rotation axis" means the axis of rotation of the rotor.
- 1/00 Wind motors with rotation axis substantially in wind direction** (controlling F03D 7/00)
    - 1/02 • having a plurality of rotors
    - 1/04 • having stationary wind-guiding means, e.g. with shrouds or channels (F03D 1/02 takes precedence)
    - 1/06 • Rotors
  - 3/00 Wind motors with rotation axis substantially at right angle to wind direction** (controlling F03D 7/00)
    - 3/02 • having a plurality of rotors
    - 3/04 • having stationary wind-guiding means, e.g. with shrouds or channels (F03D 3/02 takes precedence)
    - 3/06 • Rotors
  - 5/00 Other wind motors** (controlling F03D 7/00)
    - 5/02 • the wind-engaging parts being attached to endless chains or the like
    - 5/04 • the wind-engaging parts being attached to carriages running on tracks or the like
    - 5/06 • the wind-engaging parts swinging to-and-fro and not rotating
  - 7/00 Controlling wind motors** (supplying or distributing electrical power H02J, e.g. arrangements for adjusting, eliminating or compensating reactive power in networks H02J 3/18; controlling electric generators H02P, e.g. arrangements for controlling electric generators for the purpose of obtaining a desired output H02P 9/00)
    - 7/02 • the wind motors having rotation axis substantially in wind direction
    - 7/04 • • Automatic control; Regulation
    - 7/06 • the wind motors having rotation axis substantially at right angle to wind direction
  - 9/00 Adaptations of wind motors for special use; Combinations of wind motors with apparatus driven thereby** (arrangements in connection with vehicle propulsion units with power supply from wind B60K 16/00; propulsion of ships or other waterborne vessels by wind motors driving water-engaging propulsive elements B63H 13/00; pumps characterised by combination with wind motors F04B 17/02)
    - 9/02 • the apparatus storing power
  - 11/00 Details, component parts, or accessories not provided for in, or of interest apart from, the other groups of this subclass**
    - 11/02 • Transmission of power, e.g. using hollow exhausting blades
    - 11/04 • Mounting structures

## F03D

**F03G SPRING, WEIGHT, INERTIA, OR LIKE MOTORS; MECHANICAL-POWER-PRODUCING DEVICES OR MECHANISMS, NOT OTHERWISE PROVIDED FOR OR USING ENERGY SOURCES NOT OTHERWISE PROVIDED FOR** (arrangements in connection with power supply in vehicles from force of nature B60K 16/00; electric propulsion with power supply in vehicles from force of nature B60L 8/00)

### Note(s)

In this subclass, the following term is used with the meaning indicated:

- "motors" means mechanisms for producing mechanical power from potential energy of solid bodies.

**1/00 Spring motors** (spring-driven toys A63H; springs in general F16F; precision time mechanisms, e.g. for clocks or watches, G04B)

1/02 • characterised by shape or material of spring, e.g. helical, spiral, coil

1/04 • • using rubber springs

1/06 • Other parts or details

1/08 • • for winding

1/10 • • for producing output movement other than rotary, e.g. vibratory

**3/00 Other motors, e.g. gravity or inertia motors**

3/02 • using wheels with circumferentially-arranged compartments co-operating with solid falling bodies (F03G 3/04 takes precedence)

3/04 • driven by sand or like fluent solid material

3/06 • using pendulums

3/08 • using flywheels

**4/00 Devices for producing mechanical power from geothermal energy [5]**

4/02 • with direct fluid contact [5]

4/04 • with deep-well turbo-pump [5]

4/06 • with fluid flashing [5]

**5/00 Devices for producing mechanical power from muscle energy** (driving cycles B62M)

5/02 • of endless-walk type, e.g. treadmills

5/04 • • Horsemills or the like

5/06 • other than of endless-walk type

5/08 • • for combined actuation by different limbs, e.g. hand and leg

**6/00 Devices for producing mechanical power from solar energy** (solar boilers F24) [5]

6/02 • using a single state working fluid [5]

6/04 • • gaseous [5]

6/06 • with solar energy concentrating means [5]

**7/00 Mechanical-power-producing mechanisms, not otherwise provided for or using energy sources not otherwise provided for**

7/04 • using pressure differences or thermal differences occurring in nature (F03G 7/06 takes precedence)

7/05 • • Ocean thermal energy conversion, i.e. OTEC [5]

7/06 • using expansion or contraction of bodies due to heating, cooling, moistening, drying, or the like (using thermal expansion of non-vaporising liquids F01K)

7/08 • recovering energy derived from swinging, rolling, pitching, or like movements, e.g. from the vibrations of a machine

7/10 • Alleged *perpetua mobilia* (using hydrostatic thrust F03B 17/04)

**F03H PRODUCING A REACTIVE PROPULSIVE THRUST, NOT OTHERWISE PROVIDED FOR** (from combustion products F02K)

**1/00 Use of plasma to produce a reactive propulsive thrust** (generating plasma H05H 1/00)

**99/00 Subject matter not provided for in other groups of this subclass [2009.01]**

**3/00 Use of photons to produce a reactive propulsive thrust**

**F04 POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS**

### Note(s)

Combinations of positive-displacement and non-positive-displacement pumps are classified in subclass F04B as a general subclass for pumps, and in subclasses F04C, F04D in respect of matter specific to those subclasses.

**F04B POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS** (engine fuel-injection pumps F02M; machines for liquids, or pumps, of rotary-piston or oscillating-piston type F04C; non-positive-displacement pumps F04D; pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped F04F; crankshafts, crossheads, connecting-rods F16C; flywheels F16F; gearings for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, in general F16J; ion pumps H01J 41/12; electrodynamic pumps H02K 44/02)

#### Note(s)

- In this subclass, the following term is used with the meaning indicated:
  - "piston" also covers a plunger.
- Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".
- Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "machines", "pumps", and "positive-displacement".
- Machines, pumps or pumping installations having flexible working members are classified in groups F04B 43/00 or F04B 45/00.

#### Subclass index

##### POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS, PUMPS IN GENERAL

###### General characteristics of machines and pumps

multiple cylinders; single cylinders, pistons coating in cylinder; differential-surface pistons;  
flexible working members.....1/00, 3/00, 5/00, 43/00  
positively-driven distribution members; driving or driven means to or from working members.....7/00, 9/00  
equalization of pulses, counteracting cavitation.....11/00  
other characteristics.....19/00

###### Characteristics peculiar to pumps, their adaptations or combinations

delivering measured quantities; handling specific fluids; pumping from great depths.....13/00, 15/00, 47/00  
associated with specific driving engines.....17/00

###### Other characteristics

.....19/00

###### Pumping installations or systems

.....23/00, 43/00, 47/00

###### Component parts, details or accessories

.....53/00

##### PUMPS FOR ELASTIC FLUIDS

###### General characteristics

multiple stages; multiple cylinders.....25/00, 27/00  
free piston; flexible working member; actuation by muscle power.....31/00, 45/00, 33/00  
driving means.....35/00

###### For pumping from great depths

.....47/00

###### Other characteristics; other details or accessories

.....37/00, 39/00

###### Pumping installations or systems

.....41/00, 45/00, 47/00

CONTROL, SAFETY MEASURES; TESTING.....49/00, 51/00

COMPONENT PARTS, DETAILS OR ACCESSORIES.....53/00

#### **Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids**

**1/00 Multi-cylinder machines or pumps characterised by number or arrangement of cylinders** (F04B 3/00 takes precedence; fluid-driven pumps F04B 9/08; control of reciprocating machines or pumps in general F04B 49/00)

1/02 • having two cylinders (in V-arrangement F04B 1/04)

1/04 • having cylinders in star- or fan-arrangement [6]

1/047 • • with an actuating or actuated element at the outer ends of the cylinders [6]

1/053 • • with an actuating or actuated element at the inner ends of the cylinders [6]

1/06 • • Control

1/07 • • • by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [6]

1/08 • • • regulated by delivery pressure

1/10 • • the cylinders being movable, e.g. rotary [6]

1/107 • • • with an actuating or actuated element at the outer ends of the cylinders [6]

1/113 • • • with an actuating or actuated element at the inner ends of the cylinders [6]

1/12 • having cylinder axes coaxial with, or parallel or inclined to, main shaft axis

1/14 • • having stationary cylinders

1/16 • • • having two or more sets of cylinders or pistons

1/18 • • • having self-acting distribution members, i.e. actuated by working fluid

1/20 • • having rotary cylinder block

1/22 • • • having two or more sets of cylinders or pistons

1/24 • • • • inclined to main shaft axis

1/26 • • Control

1/28 • • • for machines or pumps with stationary cylinders

1/29 • • • • by varying the relative positions of a swash plate and a cylinder block [6]

1/30 • • • for machines or pumps with rotary cylinder block

1/32 • • • • by varying the relative positions of a swash plate and a cylinder block [6]

- 1/34 • Control not provided for in a single group of groups F04B 1/02-F04B 1/32 [6]
- 3/00 Machines or pumps with pistons coacting within one cylinder, e.g. multi-stage**
- 5/00 Machines or pumps with differential-surface pistons**  
5/02 • with double-acting pistons [6]
- 7/00 Piston machines or pumps characterised by having positively-driven valving** (with cylinders in star- or fan-arrangement F04B 1/04; with cylinder axes coaxial with, or parallel or inclined to, main shaft axis F04B 1/12)  
7/02 • the valving being fluid-actuated  
7/04 • in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports [3]  
7/06 • • the pistons and cylinders being relatively reciprocated and rotated [3]
- 9/00 Piston machines or pumps characterised by the driving or driven means to or from their working members**  
9/02 • the means being mechanical  
9/04 • • the means being cams, eccentrics, or pin-and-slot mechanisms (with cylinder axes coaxial with, or parallel or inclined to, main shaft axis F04B 1/12)  
9/06 • • the means including spring- or weight-loaded lost-motion devices  
9/08 • the means being fluid  
9/10 • • the fluid being liquid  
9/103 • • • having only one pumping chamber [6]  
9/105 • • • • reciprocating movement of the pumping member being obtained by a double-acting liquid motor [6]  
9/107 • • • • rectilinear movement of the pumping member in the working direction being obtained by a single-acting liquid motor, e.g. actuated in the other direction by gravity or a spring [6]  
9/109 • • • having plural pumping chambers [6]  
9/111 • • • • with two mechanically connected pumping members [6]  
9/113 • • • • • reciprocating movement of the pumping members being obtained by a double-acting liquid motor [6]  
9/115 • • • • • reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction [6]  
9/117 • • • • • the pumping members not being mechanically connected to each other [6]  
9/12 • • the fluid being elastic, e.g. steam or air  
9/123 • • • having only one pumping chamber [6]  
9/125 • • • • reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor [6]  
9/127 • • • • • rectilinear movement of the pumping member in the working direction being obtained by a single-acting elastic-fluid motor, e.g. actuated in the other direction by gravity or a spring [6]  
9/129 • • • having plural pumping chambers [6]  
9/131 • • • • with two mechanically connected pumping members [6]
- 9/133 • • • • • reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor [6]  
9/135 • • • • • reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction [6]  
9/137 • • • • • the pumping members not being mechanically connected to each other [6]  
9/14 • Pumps characterised by muscle-power operation
- 11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation**
- 13/00 Pumps specially modified to deliver fixed or variable measured quantities** (for transferring liquid from bulk storage containers or reservoirs into vehicles or into portable containers B67D 7/58)  
13/02 • of two or more fluids at the same time
- 15/00 Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**  
15/02 • the fluids being viscous or non-homogeneous  
15/04 • the fluids being hot or corrosive (F04B 15/06 takes precedence)  
15/06 • for liquids near their boiling point, e.g. under subnormal pressure  
15/08 • • the liquids having low boiling points
- 17/00 Pumps characterised by combination with, or adaptation to, specific driving engines or motors**  
17/02 • driven by wind motors  
17/03 • driven by electric motors [6]  
17/04 • • using solenoids [6]  
17/05 • driven by internal-combustion engines [6]  
17/06 • Mobile combinations
- 19/00 Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups F04B 1/00-F04B 17/00**  
19/02 • having movable cylinders  
19/04 • Pumps for special use (for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers B67D 7/58)  
19/06 • • Pumps for delivery of both liquid and elastic fluids at the same time (wet gas pumps F04B 37/20) [6]  
19/08 • Scoop devices  
19/10 • • of wheel type  
19/12 • • of helical or screw type  
19/14 • • of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders  
19/16 • Adhesion-type liquid-lifting devices  
19/18 • • Adhesion members therefor  
19/20 • Other positive-displacement pumps  
19/22 • • of reciprocating-piston type  
19/24 • • Pumping by heat expansion of pumped fluid
- 23/00 Pumping installations or systems** (F04B 17/00 takes precedence)  
23/02 • having reservoirs  
23/04 • Combinations of two or more pumps  
23/06 • • the pumps being all of reciprocating positive-displacement type  
23/08 • • the pumps being of different types  
23/10 • • • at least one pump being of the reciprocating positive-displacement type

- 23/12 • • • at least one pump being of the rotary-piston positive-displacement type (F04B 23/10 takes precedence)
- 23/14 • • • at least one pump being of the non-positive-displacement type (F04B 23/10, F04B 23/12 take precedence)

### Pumps specially adapted for elastic fluids

#### **25/00 Multi-stage pumps specially adapted for elastic fluids**

- 25/02 • of stepped-piston type
- 25/04 • having cylinders coaxial with, or parallel or inclined to, main shaft axis

#### **27/00 Multi-cylinder pumps specially adapted for elastic fluids and characterised by number or arrangement of cylinders** (F04B 25/00 takes precedence; control of reciprocating machines or pumps in general F04B 49/00)

- 27/02 • having cylinders arranged oppositely relative to main shaft
- 27/04 • having cylinders in star- or fan-arrangement [6]
- 27/047 • • with an actuating element at the outer ends of the cylinders [6]
- 27/053 • • with an actuating element at the inner ends of the cylinders [6]
- 27/06 • • the cylinders being movable, e.g. rotary
- 27/067 • • Control [6]
- 27/073 • • • by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [6]
- 27/08 • having cylinders coaxial with, or parallel or inclined to, main shaft axis
- 27/10 • • having stationary cylinders [6]
- 27/12 • • • having plural sets of cylinders or pistons [6]
- 27/14 • • Control [6]
- 27/16 • • • of pumps with stationary cylinders [6]
- 27/18 • • • • by varying the relative positions of a swash plate and a cylinder block [6]
- 27/20 • • • of pumps with rotary cylinder block [6]
- 27/22 • • • • by varying the relative positions of a swash plate and a cylinder block [6]
- 27/24 • Control not provided for in a single group of groups F04B 27/02-F04B 27/22 [6]

#### **31/00 Free-piston pumps specially adapted for elastic fluids; Systems incorporating such pumps** (muscle-driven pumps in which the stroke is not defined by gearing F04B 33/00; free-piston combustion engines, free-piston gas generators F02B 71/00; systems predominated by prime mover aspects, see the relevant class for the prime mover)

#### **33/00 Pumps specially adapted for elastic fluids actuated by muscle power, e.g. for inflating**

- 33/02 • with intermediate gearing

#### **35/00 Piston pumps specially adapted for elastic fluids and characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for** (predominant aspects of the engines or motors, see the relevant classes)

- 35/01 • the means being mechanical [6]
- 35/02 • the means being fluid
- 35/04 • the means being electric
- 35/06 • Mobile combinations

#### **37/00 Pumps specially adapted for elastic fluids and having pertinent characteristics not provided for in, or of interest apart from, groups F04B 25/00-F04B 35/00**

- 37/02 • for evacuating by absorption or adsorption (absorption or adsorption in general B01J)
- 37/04 • • Selection of specific absorption or adsorption materials
- 37/06 • for evacuating by thermal means
- 37/08 • • by condensing or freezing, e.g. cryogenic pumps (cold traps B01D 8/00)
- 37/10 • for special use (F04B 37/02, F04B 37/06 take precedence)
- 37/12 • • to obtain high pressure
- 37/14 • • to obtain high vacuum
- 37/16 • • • Means for nullifying unswept space
- 37/18 • • for specific elastic fluids
- 37/20 • • • for wet gases, e.g. wet air

#### **39/00 Component parts, details, or accessories, of pumps or pumping systems specially adapted for elastic fluids, not otherwise provided for in, or of interest apart from, groups F04B 25/00-F04B 37/00** (for controlling F04B 49/00)

- 39/02 • Lubrication (of machines or engines in general F01M)
- 39/04 • Measures to avoid lubricant contaminating the pumped fluid
- 39/06 • Cooling (of machines or engines in general F01P); Heating; Prevention of freezing
- 39/08 • Actuation of distribution members
- 39/10 • Adaptation or arrangement of distribution members
- 39/12 • Casings (casings for machines or engines in general F16M); Cylinders; Cylinder heads; Fluid connections
- 39/14 • Provisions for readily assembling or disassembling
- 39/16 • Filtration; Moisture separation

#### **41/00 Pumping installations or systems specially adapted for elastic fluids** (F04B 31/00, F04B 35/00 take precedence)

- 41/02 • having reservoirs
- 41/04 • Conversion of internal-combustion engine cylinder units to pumps
- 41/06 • Combinations of two or more pumps

### Machines or pumps having flexible working members

#### **43/00 Machines, pumps, or pumping installations having flexible working members** (pumps or pumping installations specially adapted for elastic fluids F04B 45/00)

- 43/02 • having plate-like flexible members, e.g. diaphragms (F04B 43/14 takes precedence) [3]
- 43/04 • • Pumps having electric drive
- 43/06 • • Pumps having fluid drive
- 43/067 • • • the fluid being actuated directly by a piston [6]
- 43/073 • • • the actuating fluid being controlled by at least one valve [6]
- 43/08 • having tubular flexible members (F04B 43/12 takes precedence)
- 43/09 • • Pumps having electric drive [6]
- 43/10 • • Pumps having fluid drive
- 43/107 • • • the fluid being actuated directly by a piston [6]
- 43/113 • • • the actuating fluid being controlled by at least one valve [6]
- 43/12 • having peristaltic action
- 43/14 • • having plate-like flexible members [3]

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### 45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids

- 45/02 • having bellows
- 45/027 • • having electric drive [6]
- 45/033 • • having fluid drive [6]
- 45/04 • having plate-like flexible members, e.g. diaphragms (F04B 45/10 takes precedence) [3]
- 45/047 • • Pumps having electric drive [6]
- 45/053 • • Pumps having fluid drive [6]
- 45/06 • having tubular flexible members (F04B 45/02, F04B 45/08 take precedence) [3]
- 45/067 • • Pumps having electric drive [6]
- 45/073 • • Pumps having fluid drive [6]
- 45/08 • having peristaltic action [3]
- 45/10 • • having plate-like flexible members [3]

### 47/00 Pumps or pumping installations specially adapted for raising fluids from great depths, e.g. well pumps (by using positive or negative pressurised fluid medium acting directly on the liquid to be pumped F04F 1/00)

- 47/02 • the driving mechanisms being situated at ground level (F04B 47/12 takes precedence)
- 47/04 • • the driving means incorporating fluid means
- 47/06 • having motor-pump units situated at great depth
- 47/08 • • the motors being actuated by fluid
- 47/10 • • • the units or parts thereof being liftable to ground level by fluid pressure
- 47/12 • having free plunger lifting the fluid to the surface
- 47/14 • Counterbalancing

### 49/00 Control of, or safety measures for, machines, pumps, or pumping installations, not otherwise provided for in, or of interest apart from, groups F04B 1/00-F04B 47/00

- 49/02 • Stopping, starting, unloading, or idling control (controlled electrically F04B 49/06) [6]
- 49/025 • • by means of floats [6]
- 49/03 • • by means of valves [6]

- 49/035 • • • Bypassing [6]
- 49/04 • Regulating by means of floats (F04B 49/025 takes precedence) [6]
- 49/06 • Control using electricity (regulating by means of floats actuating electric switches F04B 49/04)
- 49/08 • Regulating by delivery pressure
- 49/10 • Other safety measures
- 49/12 • by varying the length of stroke of the working members [6]
- 49/14 • • Adjusting abutments located in the path of reciprocation [6]
- 49/16 • by adjusting the capacity of dead spaces of working chambers [6]
- 49/18 • by changing the effective cross-section of the working surface of the piston [6]
- 49/20 • by changing the driving speed (controlled electrically F04B 49/06) [6]
- 49/22 • by means of valves (F04B 49/03 takes precedence) [6]
- 49/24 • • Bypassing [6]

### 51/00 Testing machines, pumps, or pumping installations

### 53/00 Component parts, details or accessories not provided for in, or of interest apart from, groups F04B 1/00-F04B 23/00 or F04B 39/00-F04B 47/00 [6]

- 53/02 • Packing the free space between cylinders and pistons [6]
- 53/04 • Draining [6]
- 53/06 • Venting [6]
- 53/08 • Cooling (of machines or engines in general F01P); Heating; Preventing freezing [6]
- 53/10 • Valves; Arrangement of valves [6]
- 53/12 • • arranged in or on pistons [6]
- 53/14 • Pistons, piston-rods or piston-rod connections [6]
- 53/16 • Casings; Cylinders; Cylinder liners or heads; Fluid connections [6]
- 53/18 • Lubricating (of machines or engines in general F01M) [6]
- 53/20 • Filtering [6]
- 53/22 • Arrangements for enabling ready assembly or disassembly [6]

## F04C ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS (engines driven by liquids F03C); ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT PUMPS (engine fuel-injection pumps F02M)

### Note(s)

Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "machines", "pumps", "positive displacement", "rotary-piston machines", "oscillating-piston machines", "rotary piston", "co-operating members", "movement of co-operating members", "teeth or tooth-equivalents", and "internal axis".

### Subclass index

#### MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR FOR LIQUIDS AND ELASTIC FLUIDS

##### Rotary-piston

- general characteristics; non-parallel axes of movement of co-operating members.....2/00, 3/00
- resiliently-deformable chamber walls; fluid ring.....5/00, 7/00

##### Oscillating-piston.....9/00

##### Combinations or adaptations.....11/00, 13/00

##### Pump installations.....11/00

##### Control; monitoring; safety arrangements.....14/00

##### Other details or accessories.....15/00

#### PUMPS SPECIALLY ADAPTED FOR ELASTIC FLUIDS

##### Rotary-piston pumps.....18/00

Rotary-piston pumps with fluid ring or the like.....	19/00
Oscillating-piston pumps.....	21/00
Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type; Pumping installations; Multi-stage pumps.....	23/00
Adaptations of pumps for special use.....	25/00
Sealing arrangements in rotary-piston pumps.....	27/00
Control; monitoring; safety arrangements.....	28/00
Other components parts, details or accessories.....	29/00

### **Machines for liquids; Pumps for liquids or for liquids and elastic fluids [2011.01]**

**2/00 Rotary-piston machines or pumps** (with non-parallel axes of co-operating members F04C 3/00; with the working-chamber walls at least partly resiliently deformable F04C 5/00; with fluid ring or the like F04C 7/00; rotary-piston pumps specially adapted for elastic fluids F04C 18/00, F04C 19/00; rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F04B) [3]

#### **Note(s)**

Group F04C 2/30 takes precedence over groups F04C 2/02-F04C 2/24.

2/02	• 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 [3]	2/24	• of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3]
2/04	• • of internal-axis type [3]	2/26	• • of internal-axis type [3]
2/06	• • of other than internal-axis type (F04C 2/063 takes precedence) [3]	2/28	• • of other than internal-axis type [3]
2/063	• • with coaxially-mounted members having continuously-changing circumferential spacing between them [3]	2/30	• having the characteristics covered by two or more of groups F04C 2/02, F04C 2/08, F04C 2/22, F04C 2/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members [3]
2/067	• • • having cam-and-follower type drive [3]	2/32	• • having both the movement defined in group F04C 2/02 and relative reciprocation between the co-operating members [3]
2/07	• • • having crankshaft-and-connecting-rod type drive [3]	2/324	• • • with vanes hinged to the inner member and reciprocating with respect to the outer member [3]
2/073	• • • having pawl-and-ratchet type drive [3]	2/328	• • • and hinged to the outer member [3]
2/077	• • • having toothed-gearing type drive [3]	2/332	• • • with vanes hinged to the outer member and reciprocating with respect to the inner member [3]
2/08	• of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3]	2/336	• • • and hinged to the inner member [3]
2/10	• • of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member [3]	2/34	• • having the movement defined in group F04C 2/08 or F04C 2/22 and relative reciprocation between the co-operating members [3]
2/107	• • • with helical teeth [3]	2/344	• • • with vanes reciprocating with respect to the inner member [3]
2/113	• • • the inner member carrying rollers intermeshing with the outer member [3]	2/348	• • • the vanes positively engaging, with circumferential play, an outer rotatable member [3]
2/12	• • of other than internal-axis type [3]	2/352	• • • the vanes being pivoted on the axis of the outer member [3]
2/14	• • • with toothed rotary pistons [3]	2/356	• • • with vanes reciprocating with respect to the outer member [3]
2/16	• • • with helical teeth, e.g. chevron-shaped, screw type [3]	2/36	• • having both the movements defined in groups F04C 2/22 and F04C 2/24 [3]
2/18	• • • with similar tooth forms (F04C 2/16 takes precedence) [3]	2/38	• • having the movement defined in group F04C 2/02 and having a hinged member (F04C 2/32 takes precedence) [3]
2/20	• • • with dissimilar tooth forms (F04C 2/16 takes precedence) [3]	2/39	• • • with vanes hinged to the inner as well as to the outer member [3]
2/22	• 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 [3]	2/40	• • having the movement defined in group F04C 2/08 or F04C 2/22 and having a hinged member [3]
		2/44	• • • with vanes hinged to the inner member [3]
		2/46	• • • with vanes hinged to the outer member [3]
		<b>3/00 Rotary-piston machines or pumps, with non-parallel axes of movement of co-operating members, e.g. of screw type</b> (with the working-chamber walls at least partly resiliently deformable F04C 5/00; rotary-piston pumps with non-parallel axes of movement of co-operating members specially adapted for elastic fluids F04C 18/48)	
		3/02	• the axes being arranged at an angle of 90 degrees [5]
		3/04	• • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]

## F04C

- 3/06 • the axes being arranged otherwise than at an angle of 90 degrees [5]
- 3/08 • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]
- 5/00 **Rotary-piston machines or pumps with the working-chamber walls at least partly resiliently deformable** (such pumps specially adapted for elastic fluids F04C 18/00)
- 7/00 **Rotary-piston machines or pumps with fluid ring or the like** (such pumps specially adapted for elastic fluids F04C 19/00)
- 9/00 **Oscillating-piston machines or pumps** (such pumps specially adapted for elastic fluids F04C 21/00)
- 11/00 **Combinations of two or more machines or pumps, each being of rotary-piston or oscillating-piston type** (combinations of such pumps specially adapted for elastic fluids F04C 23/00); **Pumping installations** (F04C 13/00 takes precedence; specially adapted for elastic fluids F04C 23/00; fluid gearing F16H 39/00-F16H 47/00)
- 13/00 **Adaptations of machines or pumps for special use, e.g. for extremely high pressures** (of pumps specially adapted for elastic fluids F04C 25/00)
- 14/00 **Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations** (of pumps or pumping installations specially adapted for elastic fluids F04C 28/00) [2006.01]
- 14/02 • specially adapted for several machines or pumps connected in series or in parallel [2006.01]
- 14/04 • specially adapted for reversible machines or pumps [2006.01]
- 14/06 • specially adapted for stopping, starting, idling or no-load operation [2006.01]
- 14/08 • characterised by varying the rotational speed [2006.01]
- 14/10 • characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [2006.01]
- 14/12 • • using sliding valves [2006.01]
- 14/14 • • using rotating valves [2006.01]
- 14/16 • • using lift valves [2006.01]
- 14/18 • characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 14/10) [2006.01]
- 14/20 • • by changing the form of the inner or outer contour of the working chamber [2006.01]
- 14/22 • • by changing the eccentricity between cooperating members [2006.01]
- 14/24 • characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F04C 14/10 takes precedence) [2006.01]
- 14/26 • • using bypass channels [2006.01]
- 14/28 • Safety arrangements; Monitoring [2006.01]
- 15/00 **Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups F04C 2/00-F04C 14/00** (of pumps specially adapted for elastic fluids F04C 18/00-F04C 29/00) [1, 2006.01]
- 15/06 • Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet [2006.01]

## Pumps specially adapted for elastic fluids

- 18/00 **Rotary-piston pumps specially adapted for elastic fluids** (with fluid ring or the like F04C 19/00; rotary-piston pumps in which the working-fluid is exclusively displaced by one or more reciprocating pistons F04B) [3]
- Note(s)**  
Group F04C 18/30 takes precedence over groups F04C 18/02-F04C 18/24.
- 18/02 • 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 [3]
- 18/04 • • of internal-axis type [3]
- 18/06 • • of other than internal-axis type (F04C 18/063 takes precedence) [3]
- 18/063 • • with coaxially-mounted members having continuously-changing circumferential spacing between them [3]
- 18/067 • • • having cam-and-follower type drive [3]
- 18/07 • • • having crankshaft-and-connecting-rod type drive [3]
- 18/073 • • • having pawl-and-ratchet type drive [3]
- 18/077 • • • having toothed-gearing type drive [3]
- 18/08 • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3]
- 18/10 • • of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member [3]
- 18/107 • • • with helical teeth [3]
- 18/113 • • • the inner member carrying rollers intermeshing with the outer member [3]
- 18/12 • • of other than internal-axis type [3]
- 18/14 • • • with toothed rotary pistons [3]
- 18/16 • • • with helical teeth, e.g. chevron-shaped, screw type [3]
- 18/18 • • • with similar tooth forms (F04C 18/16 takes precedence) [3]
- 18/20 • • • with dissimilar tooth forms (F04C 18/16 takes precedence) [3]
- 18/22 • 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 [3]
- 18/24 • of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3]
- 18/26 • • of internal-axis type [3]
- 18/28 • • of other than internal-axis type [3]
- 18/30 • having the characteristics covered by two or more of groups F04C 18/02, F04C 18/08, F04C 18/22, F04C 18/24, F04C 18/48, or having the characteristics covered by one of these groups together with some other type of movement between co-operating members [3]
- 18/32 • • having both the movement defined in group F04C 18/02 and relative reciprocation between the co-operating members [3]
- 18/324 • • • with vanes hinged to the inner member and reciprocating with respect to the outer member [3]
- 18/328 • • • and hinged to the outer member [3]

- 18/332 • • • with vanes hinged to the outer member and reciprocating with respect to the inner member [3]
- 18/336 • • • • and hinged to the inner member [3]
- 18/34 • • • having the movement defined in group F04C 18/08 or F04C 18/22 and relative reciprocation between the co-operating members [3]
- 18/344 • • • with vanes reciprocating with respect to the inner member [3]
- 18/348 • • • • the vanes positively engaging, with circumferential play, an outer rotatable member [3]
- 18/352 • • • • the vanes being pivoted on the axis of the outer member [3]
- 18/356 • • • with vanes reciprocating with respect to the outer member [3]
- 18/36 • • • having both the movements defined in groups F04C 18/22 and F04C 18/24 [3]
- 18/38 • • • having the movement defined in group F04C 18/02 and having a hinged member (F04C 18/32 takes precedence) [3]
- 18/39 • • • with vanes hinged to the inner as well as to the outer member [3]
- 18/40 • • • having the movement defined in group F04C 18/08 or F04C 18/22 and having a hinged member [3]
- 18/44 • • • with vanes hinged to the inner member [3]
- 18/46 • • • with vanes hinged to the outer member [3]
- 18/48 • Rotary-piston pumps with non-parallel axes of movement of co-operating members [5]
- Note(s) [2006.01]**
- Group F04C 18/30 takes precedence over group F04C 18/48.
- 18/50 • • • the axes being arranged at an angle of 90 degrees [5]
- 18/52 • • • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]
- 18/54 • • • the axes being arranged otherwise than at an angle of 90 degrees [5]
- 18/56 • • • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]
- 19/00 Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids**
- 21/00 Oscillating-piston pumps specially adapted for elastic fluids**
- 23/00 Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type, specially adapted for elastic fluids; Pumping installations specially adapted for elastic fluids; Multi-stage pumps specially adapted for elastic fluids (F04C 25/00 takes precedence)**
- F04D NON-POSITIVE-DISPLACEMENT PUMPS (engine fuel-injection pumps F02M; ion pumps H01J 41/12; electrodynamic pumps H02K 44/02)**
- 23/02 • Pumps characterised by combination with, or adaptation to, specific driving engines or motors (predominant aspects of the engines or motors, see the relevant classes)
- 25/00 Adaptations for special use of pumps for elastic fluids**
- 25/02 • for producing high vacuum (sealing arrangements F04C 27/00; silencing F04C 29/06)
- 27/00 Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids**
- 27/02 • Liquid sealing for high-vacuum pumps
- 28/00 Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids [2006.01]**
- 28/02 • specially adapted for several pumps connected in series or in parallel [2006.01]
- 28/04 • specially adapted for reversible pumps [2006.01]
- 28/06 • specially adapted for stopping, starting, idling or no-load operation [2006.01]
- 28/08 • characterised by varying the rotational speed [2006.01]
- 28/10 • characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [2006.01]
- 28/12 • • using sliding valves [2006.01]
- 28/14 • • using rotating valves [2006.01]
- 28/16 • • using lift valves [2006.01]
- 28/18 • characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 28/10) [2006.01]
- 28/20 • • by changing the form of the inner or outer contour of the working chamber [2006.01]
- 28/22 • • by changing the eccentricity between cooperating members [2006.01]
- 28/24 • characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F04C 28/10 takes precedence) [2006.01]
- 28/26 • • using bypass channels [2006.01]
- 28/28 • Safety arrangements; Monitoring [2006.01]
- 29/00 Component parts, details, or accessories, of pumps or pumping installations specially adapted for elastic fluids, not provided for in groups F04C 18/00-F04C 28/00**
- 29/02 • Lubrication; Lubricant separation
- 29/04 • Heating; Cooling; Heat insulation
- 29/06 • Silencing
- 29/12 • Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet [2006.01]

**Note(s)**

1. This subclass covers non-positive-displacement pumps for liquids, for elastic fluids, or for liquids and elastic fluids whether rotary or not having pure rotation.

**F04D**

2. This subclass does not cover combinations of non-positive-displacement pumps with other pumps, which are covered by subclass F04B, except that the use of such other pumps for priming or boosting non-positive-displacement is covered by this subclass.
3. Attention is drawn to the Notes preceding class F01, especially as regards the definition of "pump".

**Subclass index**

**ROTARY PUMPS FOR LIQUID AND ELASTIC FLUID OR LIQUID ALONE**

- Kind of flow: radial or helico-centrifugal; axial; circumferential or transverse; other.....1/00, 3/00, 5/00, 11/00
- For handling specific fluids.....7/00
- Priming, preventing vapour lock.....9/00
- Pumping installations or systems; control.....13/00, 15/00

**ROTARY PUMPS FOR ELASTIC FLUID**

- Kind of flow: radial or helico-centrifugal; axial; other.....17/00, 19/00, 23/00
- Involving supersonic speed of fluid.....21/00
- Pumping installations; control.....25/00, 27/00

**DETAILS OR ACCESSORIES**.....29/00

**OTHER KINDS OF PUMPS**

- Pumping liquid and elastic fluid at the same time.....31/00
- With other than pure rotation.....33/00
- Wave producers.....35/00

<p><b>1/00 Radial-flow pumps, e.g. centrifugal pumps; Helico-centrifugal pumps</b> (adapted for pumping specific fluids F04D 7/00; priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00)</p> <p>1/02 • having non-centrifugal stages, e.g. centripetal</p> <p>1/04 • Helico-centrifugal pumps</p> <p>1/06 • Multi-stage pumps (F04D 1/02 takes precedence)</p> <p>1/08 • • the stages being situated concentrically</p> <p>1/10 • • with means for changing the flow-path through the stages, e.g. series/parallel</p> <p>1/12 • Pumps with scoops or like paring members protruding in the fluid circulating in a bowl</p> <p>1/14 • Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis</p> <p><b>3/00 Axial-flow pumps</b> (priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00)</p> <p>3/02 • of screw type</p> <p><b>5/00 Pumps with circumferential or transverse flow</b> (pumping liquids and elastic fluids at the same time F04D 31/00)</p> <p><b>7/00 Pumps adapted for handling specific fluids, e.g. by selection of specific materials for pumps or pump parts</b> (pumping liquids and elastic fluids at the same time F04D 31/00)</p> <p>7/02 • of centrifugal type</p> <p>7/04 • • the fluids being viscous or non-homogeneous</p> <p>7/06 • • the fluids being hot or corrosive, e.g. liquid metal</p> <p>7/08 • • the fluids being radioactive</p> <p><b>9/00 Priming; Preventing vapour lock</b></p> <p>9/02 • Self-priming pumps</p> <p>9/04 • using priming pumps; using booster pumps to prevent vapour lock</p> <p>9/06 • • of jet type</p> <p><b>11/00 Other rotary non-positive-displacement pumps</b> (pumping installations or systems F04D 13/00; pumping liquids and elastic fluids at the same time F04D 31/00)</p> <p><b>13/00 Pumping installations or systems</b> (controlling F04D 15/00; pumping liquids and elastic fluids at the same time F04D 31/00)</p>	<p>13/02 • Units comprising pumps and their driving means (predominant aspects of the driving means, <u>see</u> the relevant classes for such means)</p> <p>13/04 • • the pump being fluid-driven</p> <p>13/06 • • the pump being electrically driven</p> <p>13/08 • • • for submerged use</p> <p>13/10 • • • • adapted for use in mining bore holes</p> <p>13/12 • Combinations of two or more pumps (combinations with priming pumps or booster pumps to counter-act vapour lock F04D 9/04)</p> <p>13/14 • • the pumps being all of centrifugal type</p> <p>13/16 • with storage reservoirs</p> <p><b>15/00 Control, e.g. regulation, of pumps, pumping installations, or systems</b></p> <p>15/02 • Stopping of pumps, or operating valves, on occurrence of unwanted conditions</p>
<b>Rotary pumps specially adapted for elastic fluids</b>	
<p><b>17/00 Radial-flow pumps specially adapted for elastic fluids, e.g. centrifugal pumps; Helico-centrifugal pumps specially adapted for elastic fluids</b> (F04D 21/00 takes precedence)</p> <p>17/02 • having non-centrifugal stages, e.g. centripetal</p> <p>17/04 • • of transverse-flow type</p> <p>17/06 • Helico-centrifugal pumps</p> <p>17/08 • Centrifugal pumps</p> <p>17/10 • • for compressing or evacuating</p> <p>17/12 • • • Multi-stage pumps</p> <p>17/14 • • • • with means for changing the flow-path through the stages, e.g. series/parallel (surge control F04D 27/02)</p> <p>17/16 • • for displacing without appreciable compression</p> <p>17/18 • • characterised by use of centrifugal force of liquids entrained in pumps</p> <p><b>19/00 Axial-flow pumps specially adapted for elastic fluids</b> (F04D 21/00 takes precedence)</p> <p>19/02 • Multi-stage pumps</p> <p>19/04 • • specially adapted to the production of a high vacuum, e.g. molecular pumps</p> <p><b>21/00 Pumps specially adapted for elastic fluids involving supersonic speed of pumped fluids</b></p>	

23/00	<b>Other rotary non-positive-displacement pumps specially adapted for elastic fluids</b> (pumping installations or systems F04D 25/00)	29/058	• • • magnetic; electromagnetic [2006.01]
		29/059	• • • Roller bearings [2006.01]
		29/06	• Lubrication [1, 2006.01]
25/00	<b>Pumping installations or systems specially adapted for elastic fluids</b> (controlling F04D 27/00)	29/063	• • specially adapted for elastic fluid pumps [2006.01]
25/02	• Units comprising pumps and their driving means (predominant aspects of the driving means, <u>see</u> the relevant classes for such means)	29/08	• Sealings
25/04	• • the pump being fluid-driven	29/10	• • Shaft sealings
25/06	• • the pump being electrically driven (F04D 25/08 takes precedence)	29/12	• • • using sealing-rings
25/08	• • • the working fluid being air, e.g. for ventilation	29/14	• • • operative only when pump is inoperative
25/10	• • • the unit having provisions for automatically changing the direction of output air	29/16	• • between pressure and suction sides
25/12	• • • the unit being adapted for mounting in apertures	29/18	• Rotors (specially adapted for elastic fluids F04D 29/26)
25/14	• • • and having shutters, e.g. automatically closed when not in use	29/20	• • Mounting rotors on shafts
25/16	• Combinations of two or more pumps	29/22	• • specially for centrifugal pumps
27/00	<b>Control, e.g. regulation, of pumps, pumping installations or pumping systems specially adapted for elastic fluids</b>	29/24	• • • Vanes
27/02	• Surge control	29/26	• Rotors specially adapted for elastic fluids
		29/28	• • for centrifugal or helico-centrifugal pumps
		29/30	• • • Vanes
		29/32	• • for axial-flow pumps
		29/34	• • • Blade mountings
		29/36	• • • • adjustable
		29/38	• • • Blades
		29/40	• Casings; Connections for working fluid
		29/42	• • for radial or helico-centrifugal pumps
		29/44	• • • Fluid-guiding means, e.g. diffusers
		29/46	• • • • adjustable
		29/48	• • • • • for unidirectional fluid flow in reversible pumps
		29/50	• • • • • for reversing fluid flow
		29/52	• • for axial pumps
		29/54	• • • Fluid-guiding means, e.g. diffusers
		29/56	• • • • adjustable
		29/58	• Cooling (of machines or engines in general F01P); Heating; Diminishing heat transfer
		29/60	• Mounting; Assembling; Disassembling
		29/62	• • of radial or helico-centrifugal pumps
		29/64	• • of axial pumps
		29/66	• Combating cavitation, whirls, noise, vibration, or the like (gas-flow silencers for machines or engines in general F01N); Balancing (surge control F04D 27/02)
		29/68	• • by influencing boundary layers
		29/70	• Suction grids; Strainers; Dust separation; Cleaning
			<b>Other non-positive-displacement pumps</b>
		31/00	<b>Pumping liquids and elastic fluids at the same time</b>
		33/00	<b>Non-positive-displacement pumps with other than pure rotation, e.g. of oscillating type</b> (F04D 35/00 takes precedence; hand-held fans A45B) [2]
		35/00	<b>Pumps producing waves in liquids, i.e. wave-producers</b> (for bath tubs A47K 3/10) [2]
F04F	<b>PUMPING OF FLUID BY DIRECT CONTACT OF ANOTHER FLUID OR BY USING INERTIA OF FLUID TO BE PUMPED</b> (containers or packages with special means for dispensing liquid or semi-liquid contents by internal gaseous pressure B65D 83/14); <b>SIPHONS</b> [2]		

**Note(s)**

1. Attention is drawn to the Notes preceding class F01.
2. Combinations of pumps covered by this subclass with other pumps are only classified in this subclass if such other pumps are intended for preliminary pumping for diffusion pumps.

**Subclass index**

PUMPS USING PRESSURE OR FLOW OF ANOTHER FLUID.....	1/00, 5/00
PUMPS USING NEGATIVE PRESSURE; PUMPS USING INERTIA OF THE FLUID.....	1/00, 3/00, 7/00
DIFFUSION PUMPS, e.g. WITH FORE PUMPS.....	9/00
SIPHONS; OTHER PUMPS.....	10/00, 99/00
JET-PUMP INSTALLATIONS.....	5/54

<b>1/00</b>	<b>Pumps using positively or negatively pressurised fluid medium acting directly on the liquid to be pumped</b> (using only negative pressure F04F 3/00; jet pumps F04F 5/00; siphons F04F 10/00)	5/22	• • • • of multi-stage type
1/02	• using both positively and negatively pressurised fluid medium, e.g. alternating	5/24	• • displacing liquids, e.g. containing solids, or liquids and elastic fluids
1/04	• • generated by vaporising and condensing	5/26	• • • of multi-stage type (F04F 5/28 takes precedence)
1/06	• the fluid medium acting on the surface of the liquid to be pumped (F04F 1/02 takes precedence)	5/28	• • • Restarting of inducing action
1/08	• • specially adapted for raising liquids from great depths, e.g. in wells	5/30	• • • • with axially-slidable combining nozzle
1/10	• • of multiple type, e.g. with two or more units in parallel (F04F 1/08 takes precedence)	5/32	• • • • with hinged flap in combining nozzle
1/12	• • • in series	5/34	• characterised by means for changing inducing-fluid source
1/14	• • adapted to pump specific liquids, e.g. corrosive or hot liquids	5/36	• • characterised by using specific inducing fluid
1/16	• • characterised by the fluid medium being suddenly pressurised, e.g. by explosion	5/38	• • • the inducing fluid being mercury vapour
1/18	• the fluid medium being mixed with, or generated from, the liquid to be pumped	5/40	• • • the inducing fluid being oil vapour
1/20	• • specially adapted for raising liquids from great depths, e.g. in wells	5/42	• characterised by the input flow of inducing fluid medium being radial or tangential to output flow (cyclones B04C)
<b>3/00</b>	<b>Pumps using negative pressure acting directly on the liquid to be pumped</b> (siphons F04F 10/00)	5/44	• Component parts, details, or accessories not provided for in, or of interest apart from, groups F04F 5/02-F04F 5/42
<b>5/00</b>	<b>Jet pumps, i.e. devices in which fluid flow is induced by pressure drop caused by velocity of another fluid flow</b> (diffusion pumps F04F 9/00; combination of jet pumps with pumps of other than jet type F04B; use of jet pumps for priming or boosting non-positive-displacement pumps F04D)	5/46	• • Arrangements of nozzles
5/02	• the inducing fluid being liquid	5/48	• • Control
5/04	• • displacing elastic fluids	5/50	• • • of compressing pumps
5/06	• • • of rotary type	5/52	• • • of evacuating pumps
5/08	• • • the elastic fluid being entrained in a free-falling column of liquid	5/54	• Installations characterised by use of jet pumps, e.g. combinations of two or more jet pumps of different type
5/10	• • displacing liquids, e.g. containing solids, or liquids and elastic fluids	<b>7/00</b>	<b>Pumps displacing fluids by using inertia thereof, e.g. by generating vibrations therein</b>
5/12	• • • of multi-stage type	7/02	• Hydraulic rams
5/14	• the inducing fluid being elastic fluid	<b>9/00</b>	<b>Diffusion pumps</b>
5/16	• • displacing elastic fluids	9/02	• of multi-stage type
5/18	• • • for compressing	9/04	• in combination with fore pumps, e.g. use of isolating valves
5/20	• • • for evacuating	9/06	• Arrangement of vapour traps
		9/08	• Control
		<b>10/00</b>	<b>Siphons</b>
		10/02	• Gravity-actuated siphons
		<b>13/00</b>	<b>Pressure exchangers [2009.01]</b>
		<b>99/00</b>	<b>Subject matter not provided for in other groups of this subclass [2009.01]</b>

## ENGINEERING IN GENERAL

### F15 FLUID-PRESSURE ACTUATORS; HYDRAULICS OR PNEUMATICS IN GENERAL

**F15B SYSTEMS ACTING BY MEANS OF FLUIDS IN GENERAL; FLUID-PRESSURE ACTUATORS, e.g. SERVOMOTORS; DETAILS OF FLUID-PRESSURE SYSTEMS, NOT OTHERWISE PROVIDED FOR** (motors, turbines, compressors, blowers, pumps F01-F04; fluid dynamics F15D; fluid clutches or brakes F16D; fluid springs F16F; fluid gearing F16H; pistons, cylinders, packing F16J; valves, taps, cocks, actuating-floats F16K; safety valves with auxiliary fluid operation of the main valve F16K 17/10; fluid-operating means for valves F16K 31/12; pipes, pipe joints F16L; lubricating F16N)

#### Note(s)

In this subclass, the following terms are used with the meanings indicated:

- "telemotor" means a system or device in which a substantially constant amount of fluid is trapped between an input member and an output member to act as a fluid link;
- "servomotor" means a fluid-pressure actuator, e.g. a piston and cylinder, directly controlled by a valve or other device which is responsive to operation of an initial controlling member; "Servomotor" does not cover a telemotor. The initial controlling member may be adjacent to the servomotor or at a distance, and may be, for example, a hand lever.

#### Subclass index

SUPPLYING FLUID UNDER PRESSURE.....	1/00
INTENSIFIERS OR FLUID-PRESSURE CONVERTERS; TRANSDUCERS.....	3/00, 5/00
FLUID-PRESSURE ACTUATOR SYSTEMS	
Telemotors or systems related to the output of a pump.....	7/00
Servomotors.....	9/00, 11/00, 13/00
Devices for displacing a member.....	15/00
Combinations of telemotors and servomotors; other systems; details.....	17/00, 18/00, 21/00
TESTING; SAFETY.....	19/00, 20/00

- 1/00 Installations or systems with accumulators; Supply reservoir or sump assemblies**
- 1/02 • Installations or systems with accumulators (devices damping pulsations or vibrations in fluids for use in, or in connection with, pipes or pipe systems F16L 55/04)
- 1/027 • • having accumulator charging devices (control of fluid pressure in general G05D 16/00) [6]
- 1/033 • • • with electrical control means [6]
- 1/04 • • Accumulators (connection of valves to inflatable elastic bodies B60C 29/00)
- 1/08 • • • using a gas cushion; Gas charging devices; Indicators or floats therefor [6]
- 1/10 • • • • with flexible separating means [6]
- 1/12 • • • • • attached at their periphery (F15B 1/16 takes precedence) [6]
- 1/14 • • • • • • by means of a rigid annular supporting member [6]
- 1/16 • • • • • in the form of a tube [6]
- 1/18 • • • • • Anti-extrusion means [6]
- 1/20 • • • • • • fixed to the separating means [6]
- 1/22 • • • • • Liquid port constructions [6]
- 1/24 • • • • • with rigid separating means, e.g. pistons [6]
- 1/26 • Supply reservoir or sump assemblies [6]
- 3/00 Intensifiers or fluid-pressure converters, e.g. pressure exchangers; Conveying pressure from one fluid system to another, without contact between the fluids**

- 5/00 Transducers converting variations of physical quantities, e.g. expressed by variations in positions of members, into fluid-pressure variations or vice versa; Varying fluid pressure as a function of variations of a plurality of fluid pressures or variations of other quantities** (F15B 9/00 takes precedence; for measuring or controlling G01, G05)

#### Fluid-pressure actuator systems

##### Note(s)

1. Groups F15B 7/00-F15B 21/00 cover systems in which members are moved into one or more definite positions by means of fluid pressure.
2. Pump, motor, and control features so far as not peculiar to this purpose are classified in the relevant classes.

- 7/00 Fluid-pressure actuator systems in which the movement produced is definitely related to the output of a volumetric pump; Telemotors**
- 7/02 • Systems with continuously-operating input and output apparatus
- 7/04 • in which the ratio between pump stroke and motor stroke varies with the resistance against the motor (in brake-actuating systems for motor vehicles B60T)
- 7/06 • Details (F15B 15/00 takes precedence)
- 7/08 • • Input units; Master units

- 7/10 • • Compensation of the liquid content in a system (F15B 7/08 takes precedence; pressure-maintaining arrangements for brake master cylinders B60T 11/228) [5]
- 9/00 Servomotors with follow-up action, i.e. in which the position of the actuated member conforms with that of the controlling member**
- 9/02 • with servomotors of the reciprocable or oscillatable type
- 9/03 • • with electrical control means
- 9/04 • • controlled by varying the output of a pump with variable capacity
- 9/06 • • controlled by means using a fluid jet
- 9/07 • • • with electrical control means
- 9/08 • • controlled by valves affecting the fluid feed or the fluid outlet of the servomotor (F15B 9/06 takes precedence)
- 9/09 • • • with electrical control means
- 9/10 • • • in which the controlling element and the servomotor each controls a separate member, these members influencing different fluid passages or the same passage
- 9/12 • • • in which both the controlling element and the servomotor control the same member influencing a fluid passage and are connected to that member by means of a differential gearing
- 9/14 • with rotary servomotors
- 9/16 • Systems essentially having two or more interacting servomotors
- 9/17 • • with electrical control means
- 11/00 Servomotor systems without provision for follow-up action** (F15B 3/00 takes precedence)
- 11/02 • Systems essentially incorporating special features for controlling the speed or the actuating force or speed of an output member
- 11/024 • • by means of differential connection of the servomotor lines, e.g. regenerative circuits [6]
- 11/028 • • for controlling the actuating force (F15B 11/024 takes precedence) [6]
- 11/032 • • • by means of fluid-pressure converters (fluid-pressure converters *per se* F15B 3/00) [6]
- 11/036 • • • by means of servomotors having a plurality of working chambers (servomotors *per se* F15B 15/00) [6]
- 11/04 • • for controlling the speed (F15B 11/024 takes precedence) [6]
- 11/042 • • • by regulating means in feed line (F15B 11/046, F15B 11/05 take precedence) [6]
- 11/044 • • • by regulating means in return line (F15B 11/046, F15B 11/05 take precedence) [6]
- 11/046 • • • depending on the position of the working member [6]
- 11/048 • • • • with deceleration control [6]
- 11/05 • • • specially adapted to maintain constant speed, e.g. pressure-compensated, load-responsive
- 11/06 • involving features specific to the use of a compressible medium, e.g. air, steam
- 11/064 • • with devices for saving the compressible medium [6]
- 11/068 • • with valves for gradually putting pneumatic systems under pressure [6]
- 11/072 • • Combined pneumatic-hydraulic systems [6]
- 11/076 • • • with pneumatic drive or displacement and speed control or stopping by hydraulic braking [6]
- 11/08 • with only one servomotor
- 11/10 • • in which the servomotor position is a function of the pressure
- 11/12 • • providing distinct intermediate positions; with step-by-step action
- 11/13 • • • using chambers of predetermined volume [6]
- 11/15 • • with special provision for automatic return
- 11/16 • with two or more servomotors
- 11/17 • • using two or more pumps [6]
- 11/18 • • used in combination for obtaining stepwise operation of a single controlled member
- 11/20 • • controlling several interacting or sequentially-operating members (fluid distribution or supply devices for the control of two or more servomotors F15B 13/06)
- 11/22 • • Synchronisation of the movement of two or more servomotors
- 13/00 Details of servomotor systems** (F15B 15/00 takes precedence)
- 13/01 • Locking-valves or other detent devices (associated with the actuator F15B 15/26)
- 13/02 • Fluid distribution or supply devices characterised by their adaptation to the control of servomotors (multiple-way valves F16K 11/00)
- 13/04 • • for use with a single servomotor
- 13/042 • • • operated by fluid pressure
- 13/043 • • • • with electrically-controlled pilot valves
- 13/044 • • • operated by electrically-controlled means, e.g. solenoids, torque-motors
- 13/06 • • for use with two or more servomotors
- 13/07 • • • in distinct sequence
- 13/08 • • • Assemblies of units, each for the control of a single servomotor only
- 13/10 • Special arrangements for operating the actuated device without using fluid pressure, e.g. for emergency use
- 13/12 • Special measures for increasing the sensitivity of the system
- 13/14 • Special measures for giving the operator by sense of touch the immediate response of the actuated device
- 13/16 • Special measures for feedback
- 15/00 Fluid-actuated devices for displacing a member from one position to another** (motors for continuous movement F01-F03); **Gearing associated therewith**
- 15/02 • Mechanical layout characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member
- 15/04 • • with oscillating cylinder
- 15/06 • • for mechanically converting rectilinear movement into non-rectilinear movement
- 15/08 • characterised by the construction of the motor unit (pistons, cylinders, packing F16J)
- 15/10 • • the motor being of diaphragm type (connection of valves to inflatable elastic bodies B60C 29/00; diaphragms, bellows F16J 3/00)
- 15/12 • • of the oscillating-vane or curved-cylinder type
- 15/14 • • of the straight-cylinder type
- 15/16 • • • of the telescopic type
- 15/17 • • • of differential-piston type
- 15/18 • Combined units comprising both motor and pump
- 15/19 • Pyrotechnical actuators [3]
- 15/20 • Other details
- 15/22 • • for accelerating or decelerating the stroke

- 15/24 • • for restricting the stroke
- 15/26 • • Locking mechanisms
- 15/28 • • Means for indicating the position, e.g. end of stroke [4]

**17/00 Combinations of telemotor and servomotor systems**

- 17/02 • in which a telemotor operates the control member of a servomotor

**18/00 Parallel arrangements of independent servomotor systems**

**19/00 Testing fluid-pressure actuator systems or apparatus, so far as not provided for elsewhere**

**20/00 Safety arrangements for fluid actuator systems; Applications of safety devices in fluid actuator systems; Emergency measures for fluid actuator systems**

**21/00 Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass**

- 21/02 • Servomotor systems with programme control derived from a store or timing device; Control devices therefor
- 21/04 • Special measures taken in connection with the properties of the fluid, e.g. for venting, compensating for changes of viscosity, cooling, filtering, preventing churning
- 21/06 • Use of special fluids, e.g. liquid metal; Special adaptations of fluid-pressure systems, or control of elements therefor, to the use of such fluids
- 21/08 • Servomotor systems incorporating electrically-operated control means (F15B 21/02 takes precedence)
- 21/10 • Delay devices or arrangements (associated with fluid motors or actuators F15B 15/22)
- 21/12 • Fluid oscillators or pulse generators (fluid oscillators predominantly used for computing or control purposes F15C 1/22, F15C 3/16)
- 21/14 • Energy-recuperation means (for vehicles B60T 1/10) [6]

**F15C FLUID-CIRCUIT ELEMENTS PREDOMINANTLY USED FOR COMPUTING OR CONTROL PURPOSES** (transducers F15B 5/00; fluid dynamics in general F15D; computers comprising fluid elements G06D, G06G)

**Note(s)**

Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".

**1/00 Circuit elements having no moving parts**

- 1/02 • Details
- 1/04 • • Means for controlling fluid streams to fluid devices, e.g. by electric signals
- 1/06 • • Constructional details; Selection of specified materials

**Note(s)**

Group F15C 1/22 takes precedence over groups F15C 1/08-F15C 1/20.

- 1/08 • Boundary-layer devices, e.g. wall-attachment amplifiers [2]
- 1/10 • • for digital operation, e.g. to form a logical flip-flop, OR-gate, NOR-gate
- 1/12 • • • Multiple arrangements thereof for performing operations of the same kind, e.g. majority gates, identity gates
- 1/14 • Stream-interaction devices; Momentum-exchange devices, e.g. operating by exchange between two orthogonal fluid jets
- 1/16 • Vortex devices, i.e. devices in which use is made of the pressure drop associated with vortex motion in a fluid
- 1/18 • Turbulence devices, i.e. devices in which a controlling stream will cause a laminar flow to become turbulent

- 1/20 • Direct-impact devices, i.e. devices in which two collinear opposing power streams are impacted
- 1/22 • Oscillators [2]

**3/00 Circuit elements having moving parts** (valves, construction of valves F16K)

**Note(s)**

Group F15C 3/16 takes precedence over groups F15C 3/02-F15C 3/10.

- 3/02 • using spool valves
- 3/04 • using diaphragms (connection of valves to inflatable elastic bodies B60C 29/00)
- 3/06 • using balls
- 3/08 • using reeds
- 3/10 • using nozzles or jet pipes
- 3/12 • • the nozzle or jet pipe being movable
- 3/14 • • the jet from the nozzle being intercepted by a flap
- 3/16 • Oscillators [2]

**4/00 Circuit elements characterised by their special functions**

**5/00 Manufacture of fluid-circuit elements; Manufacture of assemblages of such elements**

**7/00 Hybrid elements, i.e. circuit elements having features according to groups F15C 1/00 and F15C 3/00 [2]**

**F15C**

**F15D FLUID DYNAMICS, i.e. METHODS OR MEANS FOR INFLUENCING THE FLOW OF GASES OR LIQUIDS** (fluid-circuit elements F15C)

**Note(s)**

This subclass covers boundary-layer control and other arrangements and methods, not provided for in other classes, for influencing the flow of fluids relative to constraining surfaces and after leaving these surfaces, e.g. producing or removing turbulence, deflecting jets, guiding flow through bends in conduits, affecting distribution of fluid in a conduit, reducing fluid friction.

- 1/00 **Influencing the flow of fluids**
- 1/02 • in pipes or conduits
- 1/04 • • Arrangements of guide vanes in pipe elbows or duct bends; Construction of pipe conduit elements or elbows with respect to flow, specially for reducing losses of flow
- 1/06 • • by influencing the boundary layer
- 1/08 • of jets leaving an orifice (nozzles or outlets with means for mechanically breaking-up or deflecting the jet B05B, e.g. B05B 1/26)
- 1/10 • around bodies of solid material
- 1/12 • • by influencing the boundary layer
- 1/14 • Diverting flow into alternative channels (in hydraulic engineering E02B)

**F16 ENGINEERING ELEMENTS OR UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL**

**F16B DEVICES FOR FASTENING OR SECURING CONSTRUCTIONAL ELEMENTS OR MACHINE PARTS TOGETHER, e.g. NAILS, BOLTS, CIRCLIPS, CLAMPS, CLIPS OR WEDGES; JOINTS OR JOINTING** (couplings for transmitting rotation F16D)

**Note(s)**

Attention is drawn to:

- a. the Note following group E04B 1/38;
- b. the following places:
  - A44B.....Buckles, slide fasteners
  - A47G 3/00.....Ornamental heads for nails, screws, or the like
  - B42F 3/00.....Means, not using staples, for attaching sheets temporarily together
  - E01B 9/10.....Screws or bolts for railway sleepers
  - E01B 11/00.....Rail joints
  - E04.....Connections for building
  - E04D 13/08.....Clamping means for down pipes for roof drainage
  - E04F 13/21.....Fastening means specially adapted for covering or lining elements for buildings
  - E04G 5/04.....Fastening scaffolds against buildings
  - E04G 7/00.....Scaffolding couplings
  - E05C.....Bolts or fasteners for wings, specially for doors or windows
  - F16C 29/10.....Locking bearings for parts moving only linearly
  - F16G 17/00.....Hooks as integral parts of chains
  - F16L.....Pipe joints
  - F16L 3/00.....Supports for pipes, cables or protective tubing, e.g. hangers, holders, clamps, cleats, clips, brackets
  - F16L 33/02.....Clips for connecting hoses to rigid members
  - H01F 7/00.....Magnetic holding devices
  - H02N 13/00.....Electrostatic holding devices.

**Subclass index**

**TYPES OF FASTENING**

- By: clamping, wedging.....2/00, 3/00
- By: shrinking or force fit; sticking or pressing together; penetration of one member into a hole in another.....4/00, 11/00, 17/00
- Fastening of plates, strips, bars, or tubes together or to flat surfaces.....5/00, 7/00, 9/00
- For specific applications
  - for furniture.....12/00
  - for fixing in walls.....13/00
  - by screw-thread modified in view of tensile load.....31/00

**FASTENING MEANS**

- General
  - clamps; clips; wedges, keys.....2/00, 3/00

dowels.....	13/00
other fastening means.....	1/00, 45/00, 47/00
Without screw-thread	
nails, staples; bolts, pins, or rivets.....	15/00, 19/00
locking stud-and-socket fastenings against axial movement.....	21/00
With screw-thread	
screws; bolts, break-bolts, nuts.....	25/00, 15/06, 27/00, 27/00, 31/00, 35/00, 37/00
features common to bolts and screws.....	23/00, 27/00, 33/00
deformation of nut or equivalent while fastening; locking of screws, bolts, or nuts.....	29/00, 39/00
Accessories for fastening means.....	41/00, 43/00

### 1/00 Devices for securing together, or preventing relative movement between, constructional elements or machine parts

#### Note(s)

Groups F16B 2/00-F16B 47/00 take precedence over group F16B 1/00.

- 1/02 • Means for securing elements of mechanisms after operation (means for bringing members to rest F16D)
- 1/04 • • disengaged by movement of the actuating member of the element (locking of actuators G05G, e.g. G05G 5/00)

### Fastenings for constructional elements or machine parts in general

- 2/00 **Friction-grip releasable fastenings** (for cables or ropes, e.g. cleats, F16G 11/00; supports for pipes, cables or protective tubing F16L 3/00)
- 2/02 • Clamps, i.e. with gripping action effected by positive means other than the inherent resistance to deformation of the material of the fastening
- 2/04 • • internal, i.e. with spreading action (F16B 2/14-F16B 2/18 take precedence)
- 2/06 • • external, i.e. with contracting action (F16B 2/14-F16B 2/18 take precedence)
- 2/08 • • • using bands (clips for connecting hoses to rigid members F16L 33/02)
- 2/10 • • • using pivoting jaws
- 2/12 • • • using sliding jaws
- 2/14 • • using wedges
- 2/16 • • using rollers or balls
- 2/18 • • using cams, levers, eccentrics, or toggles
- 2/20 • Clips, i.e. with gripping action effected solely by the inherent resistance to deformation of the material of the fastening
- 2/22 • • of resilient material, e.g. rubbery material
- 2/24 • • • of metal
- 2/26 • • of pliable non-resilient material, e.g. plant tie
- 3/00 **Key-type connections; Keys** (F16B 2/00 takes precedence; for rods or tubes mutually F16B 7/00)
- 3/04 • using keys formed of wire or other flexible material, to be inserted through an opening giving access to grooves in the adjacent surfaces of the parts to be connected
- 3/06 • using taper sleeves
- 4/00 **Shrinkage connection, e.g. assembled with the parts at different temperature; Force fits** (restricted to metal parts or objects B23P 11/02); **Non-releasable friction-grip fastenings** (F16B 2/00 takes precedence)

### 5/00 Joining sheets or plates to one another or to strips or bars parallel to them (by sticking together F16B 11/00; dowel connections F16B 13/00; pins, including deformable elements F16B 19/00; covering of walls E04F 13/00; fastening signs, plates, panels, or boards to a supporting structure, fastening readily-detachable elements, e.g. letters, to signs, plates, panels, or boards, G09F 7/00)

- 5/01 • by means of fastening elements specially adapted for honeycomb panels
- 5/02 • by means of fastening members using screw-thread (construction of screw-threaded connections F16B 25/00-F16B 39/00)
- 5/04 • by means of riveting (rivets F16B 19/04)
- 5/06 • by means of clamps or clips (friction-grip releasable fastenings in general F16B 2/00)
- 5/07 • by means of multiple interengaging protrusions on the surfaces, e.g. hooks, coils
- 5/08 • by means of welds or the like (welding B23K)
- 5/10 • by means of bayonet connections (fastening devices locking by rotation F16B 21/02)
- 5/12 • Fastening strips or bars to sheets or plates, e.g. rubber strips, decorative strips for motor vehicles, by means of clips (friction-grip releasable fastenings in general F16B 2/00; fastening rods or tubular parts to flat surfaces at an angle F16B 9/00; clips for connecting hoses to rigid members F16L 33/02)
- 7/00 **Connections of rods or tubes, e.g. of non-circular section, mutually, including resilient connections** (umbrella frames A45B 25/02; welding or soldering of connections B23K; vehicle connections in general B60D; railway couplings B61G; bicycle frames B62K; couplings for transmitting rotation F16D; couplings for tubes conveying fluid F16L)
- 7/02 • with conical parts
- 7/04 • Clamping or clipping connections (friction-grip releasable fastenings in general F16B 2/00)
- 7/06 • Turnbuckles (for cables, ropes, or wire F16G 11/12)
- 7/08 • Pipe saddles (friction-grip releasable fastenings in general F16B 2/00)
- 7/10 • Telescoping systems (for scaffolding E04G 25/04; telescope props for mining E21D 15/14-E21D 15/46; stands or trestles as supports for apparatus or articles placed thereon F16M 11/00)
- 7/12 • • locking only in extreme extended position
- 7/14 • • locking in intermediate positions
- 7/16 • • • locking only against movement in one direction
- 7/18 • using screw-thread elements
- 7/20 • using bayonet connections
- 7/22 • using hooks or like elements

**9/00 Connections of rods or tubular parts to flat surfaces at an angle** (friction-grip releasable fastenings in general F16B 2/00; making press-fit connections B23P 11/00, B23P 19/00; fluid-tight connecting of pipes to reservoirs, sheets, or the like F16L, e.g. joining pipes to walls F16L 41/00; supports for pipes, cables or protective tubing F16L 3/00)

- 9/02 • Detachable connections

**11/00 Connecting constructional elements or machine parts by sticking or pressing them together, e.g. cold pressure welding** (non-electric welding in general B23K; methods of using adhesives independently of the form of the surfaces joined C09J 5/00)

**12/00 Jointing of furniture or the like, e.g. hidden from exterior** (F16B 2/00-F16B 11/00 take precedence; fastening means per se F16B 13/00-F16B 47/00; wood-working B27)

- 12/02 • Joints between panels and corner posts
- 12/04 • Non-loosenable joints for non-metal furniture parts, e.g. glued
- 12/06 • Non-loosenable joints for metal furniture parts
- 12/08 • • without use of separate connecting elements
- 12/10 • using pegs, bolts, tenons, clamps, clips, or the like (glued F16B 12/04; fastening means per se F16B 15/00-F16B 47/00)
- 12/12 • • for non-metal furniture parts, e.g. made of wood, of plastics
- 12/14 • • • using threaded bolts or screws
- 12/16 • • • using self-tapping screws
- 12/18 • • • using drawing bars
- 12/20 • • • using clamps, clips, wedges, sliding bolts, or the like
- 12/22 • • • using keyhole-shaped slots and pins
- 12/24 • • • using separate pins, dowels, or the like
- 12/26 • • • using snap-action elements
- 12/28 • • for metal furniture parts
- 12/30 • • • using threaded bolts
- 12/32 • • • using clamps, clips, wedges, sliding bolts, or the like
- 12/34 • • • using keyhole-shaped slots and pins
- 12/36 • • • using separate pins, dowels, or the like
- 12/38 • • • using snap-action elements
- 12/40 • Joints for furniture tubing
- 12/42 • • connecting furniture tubing to non-tubular parts
- 12/44 • Leg joints; Corner joints
- 12/46 • • Non-metal corner connections
- 12/48 • • Non-metal leg connections (F16B 12/46 takes precedence)
- 12/50 • • Metal corner connections
- 12/52 • • Metal leg connections (F16B 12/50 takes precedence)
- 12/54 • Fittings for bedsteads or the like
- 12/56 • • Brackets for bedsteads; Coupling joints consisting of bolts or the like; Latches therefor
- 12/58 • • Tapered connectors for bed rails
- 12/60 • • Fittings for detachable side panels

**13/00 Dowels or other devices fastened in walls or the like by inserting them in holes made therein for that purpose** (nails F16B 15/00; self-locking pins or bolts in general, stud-and-socket releasable fastenings F16B 21/00; dowels or bolts for railroad sleepers E01B 9/00; means for anchoring structural elements or bulkheads specially adapted to foundation engineering E02D 5/74; bolts or dowels used while laying bricks or casting concrete E04B 1/38; setting anchoring bolts in shafts, tunnels or galleries E21D 20/00; anchoring bolts for shafts, tunnels or galleries E21D 21/00) [5]

- 13/02 • in one piece with protrusions or ridges on the shaft
- 13/04 • with parts gripping in the hole or behind the reverse side of the wall after inserting from the front (friction-grip releasable fastenings in general F16B 2/00)
- 13/06 • • combined with expanding sleeve
- 13/08 • • with separate gripping parts moved into their final position in relation to the body of the device without further manual operation
- 13/10 • • with separate gripping parts moved into their final position in relation to the body of the device by a separate operation (F16B 13/06 takes precedence)
- 13/12 • Separate metal dowel sleeves fastened by inserting the screw, nail, or the like
- 13/13 • • self-cutting [2]
- 13/14 • Non-metallic plugs or sleeves; Use of liquid, loose solid or kneadable material therefor [5]

#### **Fastening means without screw-thread**

**15/00 Nails; Staples** (surgical staples A61B 17/064; manufacture of nails or staples B21G; railway spikes E01B 9/06)

- 15/02 • with specially shaped heads, e.g. with enlarged surfaces (ornaments for furniture A47B 95/04; removable ornamental heads for nails A47G 3/00)
- 15/04 • with spreading shaft
- 15/06 • with barbs, e.g. for metal parts; Drive screws
- 15/08 • formed in integral series but easily separable

**17/00 Fastening means without screw-thread for connecting constructional elements or machine parts by a part of or on one member entering a hole in the other** (construction of bolts, pins, or rivets F16B 19/00; riveting F16B 19/04; means for preventing withdrawal of a pin, spigot, or the like from its operative position, stud-and-socket releasable fastenings F16B 21/00)

**19/00 Bolts without screw-thread; Pins, including deformable elements** (in screwed connections F16B 29/00); **Rivets** (means for preventing withdrawal F16B 21/00)

- 19/02 • Bolts or sleeves for positioning of machine parts, e.g. notched taper pins, fitting pins, sleeves, eccentric positioning rings
- 19/04 • Rivets; Spigots or the like fastened by riveting (lead seals G09F 3/00)
- 19/05 • • Bolts fastening by swaged-on collars (F16B 19/08 takes precedence)
- 19/06 • • Solid rivets made in one piece
- 19/08 • • Hollow rivets; Multi-part rivets
- 19/10 • • • fastened by expanding mechanically
- 19/12 • • • fastened by fluid pressure, including by explosion (bolts shot by means of detonation-operated nailing tools into concrete constructions, metal walls, or the like F16B 19/14)

19/14	• Bolts or the like for shooting into concrete constructions, metal walls, or the like by means of detonation-operated nailing tools (tools therefor B25C, B27F)	33/02	• Shape of thread; Special thread-forms (used as screw-locking device F16B 39/30)
21/00	<b>Means without screw-thread for preventing relative axial movement of a pin, spigot, shaft, or the like and a member surrounding it</b> (riveted or deformable spigots F16B 19/04; for gudgeon pins F16J 1/18); <b>Stud-and-socket releasable fastenings without screw-thread</b>	33/04	• • in view of tensile load
21/02	• Releasable fastening devices locking by rotation (with snap action F16B 21/06; studs or coupling-pins with resilient protrusions F16B 21/08)	33/06	• Surface treatment of parts furnished with screw-thread, e.g. for preventing seizure
21/04	• • with bayonet catch	35/00	<b>Screw-bolts; Stay bolts; Screw-threaded studs; Screws; Set screws</b> (wall-dowels F16B 13/00; thread-cutting screws F16B 25/00)
21/06	• Releasable fastening devices with snap action	35/02	• divided longitudinally
21/07	• • in which the socket has a resilient part	35/04	• with specially-shaped head or shaft in order to fix the bolt on or in an object (locking the bolt against turning in the object by the use of accessory parts F16B 39/00)
21/08	• • in which the stud, pin, or spigot has a resilient part (wall-dowels F16B 13/00)	35/06	• • Specially-shaped heads (special shape in order to rotate the bolt F16B 23/00)
21/09	• Releasable fastening devices with a stud engaging a keyhole slot	37/00	<b>Nuts or like thread-engaging members</b> (wall-dowels F16B 13/00)
21/10	• by separate parts (key-type connection F16B 3/00; locking screws or nuts against rotation by such means F16B 39/04)	37/02	• made of thin sheet material (fastening to surfaces F16B 37/04)
21/12	• • with locking-pins or split-pins thrust into holes	37/04	• Devices for fastening nuts to surfaces, e.g. sheets, plates
21/14	• • • Details of locking-pins or split-pins	37/06	• • by means of welding or riveting
21/16	• • with grooves or notches in the pin or shaft	37/08	• Quickly-detachable nuts, e.g. consisting of two or more parts; Nuts movable along the bolt after tilting the nut
21/18	• • • with circlips or like resilient retaining devices; Details (spring-washers for locking nuts F16B 39/24; adjusting-rings F16B 43/00)	37/10	• • divided parallel or about parallel to the bolt axis
21/20	• • for bolts or shafts without holes, grooves, or notches for locking members	37/12	• with thread-engaging surfaces formed by inserted coil-springs, discs, or the like; Independent pieces of wound wire used as nuts; Threaded inserts for holes
		37/14	• Cap nuts; Nut caps or bolt caps
		37/16	• Wing nuts (F16B 37/14 takes precedence)
		39/00	<b>Locking of screws, bolts, or nuts</b> (wall-dowels F16B 13/00; locking of bottle closures B65D; locking of rail-fastening bolts for permanent ways E01B 9/12; locking of fastening means for railway fishplates E01B 11/38; locking devices for valves or cocks F16K)
<b>Fastening means using screw-thread</b>			<b>Note(s)</b> In this group, heads of screws or bolts are put on a par with nuts as far as pertains to locking; an object into which a screw is threaded is put on a par with a nut.
23/00	<b>Specially-shaped heads of bolts or screws for rotations by a tool</b>		
25/00	<b>Screws that form threads in the body into which they are screwed, e.g. wood screws, self-tapping screws [4]</b>		
25/02	• by a cutting and material removing action, e.g. fluted self-tapping screws [4]		
25/04	• by a slicing and material displacing action, e.g. wood screws with sharp thread crests [4]		
25/06	• by swaging, i.e. material deforming action [4]		
25/08	• by a combination of any two or all of the actions provided for in groups F16B 25/02-F16B 25/06 [4]		
25/10	• Screws performing an additional function to thread-forming, e.g. drill screws [4]		
27/00	<b>Bolts, screws, or nuts formed in integral series but easily separable, particularly for use in automatic machines</b>		
29/00	<b>Screwed connection with deformation of nut or auxiliary member while fastening</b> (wall-dowels F16B 13/00; members deformed for locking screws, bolts or nuts F16B 39/22)		
31/00	<b>Screwed connections specially modified in view of tensile load; Break-bolts</b> (shape of thread F16B 33/04)		
31/02	• for indicating or limiting tensile load		
31/04	• for maintaining constant tensile load		
31/06	• having regard to possibility of fatigue rupture		
33/00	<b>Features common to bolt and nut</b> (wall-dowels F16B 13/00)		
		39/01	• specially adapted to prevent loosening at extreme temperatures
		39/02	• in which the locking takes place after screwing down (F16B 39/01 takes precedence; split-pins, circlips, or the like for preventing relative axial movement only F16B 21/10; fastening nuts by welding or riveting F16B 37/06)
		39/04	• • with a member penetrating the screw-threaded surface of at least one part, e.g. a pin, wedge, cotter-pin, screw
		39/06	• • • with a pin or staple parallel to the bolt axis
		39/08	• • with a cap interacting with the nut, connected to the bolt by a pin or cotter-pin
		39/10	• • by a plate or ring immovable with regard to the bolt or object (F16B 39/08 takes precedence)
		39/12	• • by means of locknuts
		39/14	• • • made of thin sheet material or formed as spring washers (locknuts <u>per se</u> made of thin sheet material F16B 37/02)
		39/16	• • • in which the screw-thread of the locknut differs from that of the nut

**F16B**

- 39/18 • • • • in which the locknut grips with screw-thread in the nuts as well as on the bolt
- 39/20 • • by means of steel wire or the like (F16B 39/10 takes precedence)
- 39/22 • in which the locking takes place during screwing down or tightening (F16B 39/01 takes precedence)
- 39/24 • • by means of washers, spring washers, or resilient plates that lock against the object (locking to the screw-thread F16B 39/14, F16B 39/36)
- 39/26 • • • with spring washers fastened to the nut or bolt-head
- 39/28 • • by special members on, or shape of, the nut or bolt (F16B 39/26 takes precedence; locknuts F16B 39/12)
- 39/282 • • • Locking by means of special shape of work-engaging surfaces, e.g. notched or toothed nuts
- 39/284 • • • Locking by means of elastic deformation (F16B 39/38 takes precedence)
- 39/286 • • • • caused by saw cuts
- 39/30 • • • Locking exclusively by special shape of the screw-thread
- 39/32 • • • Locking by means of a pawl or pawl-like tongue
- 39/34 • • • Locking by deformable inserts or like parts
- 39/36 • • • with conical locking parts, which may be split, including use of separate rings co-operating therewith
- 39/38 • • • with a second part of the screw-thread which may be resiliently mounted (F16B 39/30 takes precedence)
- 41/00 Measures against loss of bolts, nuts, or pins; Measures against unauthorised operation of bolts, nuts, or pins** (seals G09F 3/00)
- 43/00 Washers or equivalent devices; Other devices for supporting bolt-heads or nuts** (circlips F16B 21/18; with special means for locking bolts or nuts F16B 39/10, F16B 39/24)
- 43/02 • with special provisions for engaging surfaces which are not perpendicular to a bolt axis or do not surround the bolt
- 45/00 Hooks; Eyes** (if the attaching parts or means are concerned, groups F16B 13/00, F16B 15/00, F16B 19/00, F16B 25/00, F16B 35/00, F16B 47/00 take precedence; for hanging pictures or the like A47G 1/16; towing hooks for ships B63B 21/58; for hoisting or hauling purposes B66C; hooks or eyes with integral parts designed to facilitate quick attachment to cables or ropes at any point F16G 11/14)
- 45/02 • Hooks with pivoting closing member
- 45/04 • Hooks with sliding closing member
- 45/06 • Hooks with two symmetrically-pivoting hook parts
- 47/00 Suction cups for attaching purposes; Equivalent means using adhesives**

**F16C SHAFTS; FLEXIBLE SHAFTS; MECHANICAL MEANS FOR TRANSMITTING MOVEMENT IN A FLEXIBLE SHEATHING; ELEMENTS OF CRANKSHAFT MECHANISMS; PIVOTS; PIVOTAL CONNECTIONS; ROTARY ENGINEERING ELEMENTS OTHER THAN GEARING, COUPLING, CLUTCH OR BRAKE ELEMENTS; BEARINGS [5]**

**Note(s)**

In this subclass, the following expression is used with the meaning indicated:

- "rotary engineering elements other than gearing, coupling, clutch or brake elements" covers any engineering element other than gearing, coupling, clutch or brake elements which rotates in so far as its features are affected only by the fact that it rotates.

**Subclass index**

FLEXIBLE TRANSMISSIONS, SHAFTS, AXLES, CRANKS, ECCENTRICS.....1/00, 3/00  
 CROSSHEADS, CONNECTING-RODS.....5/00, 7/00, 9/00  
 PIVOTS.....11/00  
 ROLLS, DRUMS, DISCS.....13/00  
 BEARINGS  
 For rotatable parts.....13/00, 17/00-27/00  
 For linearly-movable parts.....29/00  
 For parts which both rotate and move linearly.....31/00  
 For crankshafts or connecting- rods.....9/00  
 Not otherwise provided for.....32/00  
 Supports; parts or accessories.....27/00, 35/00, 33/00, 41/00  
 Cooling; relieving load.....37/00, 39/00  
 MAKING, ASSEMBLING.....33/00, 43/00  
 CONSTRUCTION OF ROTATABLE BODIES TO RESIST CENTRIFUGAL FORCE.....15/00

- 1/00 Flexible shafts** (flexible shafts in dental machines for boring or cutting A61C 1/18); **Mechanical means for transmitting movement in a flexible sheathing**
- 1/02 • for conveying rotary movements
- 1/04 • • Articulated shafts
- 1/06 • • with guiding-sheathing, tube, or box (F16C 1/04 takes precedence; guiding-sheathings F16C 1/26)
- 1/08 • • End connections
- 1/10 • Means for transmitting linear movement in a flexible sheathing, e.g. "Bowden mechanisms" (guiding-sheathings F16C 1/26)
- 1/12 • • Arrangements for transmitting movement to or from the flexible member

- 1/14 • • • Construction of the end-piece of the flexible member; Attachment thereof to the flexible member
- 1/16 • • • in which the end-piece is guided rectilinearly
- 1/18 • • • in which the end portion of the flexible member is laid along a curved surface of a pivoted member
- 1/20 • • Construction of flexible members moved to and fro in the sheathing
- 1/22 • • Adjusting; Compensating length
- 1/24 • Lubrication; Lubricating equipment
- 1/26 • Construction of guiding-sheathings or guiding-tubes
- 1/28 • • with built-in bearings
- 3/00 Shafts** (flexible shafts F16C 1/00; marine propeller shafts, paddle wheel shafts B63H 23/34); **Axles; Cranks; Eccentrics**
- 3/02 • Shafts; Axles
- 3/03 • • telescopic
- 3/035 • • • with built-in bearings
- 3/04 • Crankshafts, eccentric-shafts; Cranks, eccentrics
- 3/06 • • Crankshafts
- 3/08 • • • made in one piece (features relating to lubrication F16C 3/14, to cooling F16C 3/16)
- 3/10 • • • assembled of several parts, e.g. by welding
- 3/12 • • • releasably connected
- 3/14 • • • Features relating to lubrication
- 3/16 • • • Features relating to cooling
- 3/18 • • Eccentric-shafts
- 3/20 • • Shape of crankshafts or eccentric-shafts having regard to balancing
- 3/22 • • Cranks; Eccentrics (constructional features of crank-pins F16C 11/02)
- 3/24 • • • with return cranks, i.e. a second crank carried by the crank-pin
- 3/26 • • • Elastic crank-webs; Resiliently-mounted crank-pins
- 3/28 • • • Adjustable cranks or eccentrics
- 3/30 • • • with arrangements for overcoming dead-centres
- 5/00 Crossheads; Constructions of connecting-rod heads or piston-rod connections rigid with crossheads** (piston-rods, i.e. rods rigidly connected to the piston, F16J 7/00)
- 7/00 Connecting-rods or like links pivoted at both ends** (coupling-rods for locomotive driving-wheels B61C 17/10); **Construction of connecting-rod heads** (heads rigid with crossheads F16C 5/00)
- 7/02 • Constructions of connecting-rods with constant length
- 7/04 • with elastic intermediate part or fluid cushion
- 7/06 • Adjustable connecting-rods
- 7/08 • made from sheet metal
- 9/00 Bearings for crankshafts or connecting-rods; Attachment of connecting-rods** (lubrication of connecting-rods in connection with crankshafts F16C 3/14; connections to crossheads F16C 5/00, to pistons F16J 1/14)
- 9/02 • Crankshaft bearings
- 9/03 • • Arrangements for adjusting play
- 9/04 • Connecting-rod bearings; Attachment thereof
- 9/06 • • Arrangements for adjusting play in bearings, operating either automatically or not
- 11/00 Pivots; Pivotal connections** (arrangements of steering linkage connections B62D 7/16)
- 11/02 • Trunnions; Crank-pins (fastening crank-pins to webs, crank-pins integral with cranks F16C 3/06, F16C 3/22)
- 11/04 • Pivotal connections (hinges for doors, windows or wings E05D)
- 11/06 • • Ball-joints; Other joints having more than one degree of angular freedom, i.e. universal joints (universal joints in which flexibility is produced by means of pivots or sliding or rolling connecting parts F16D 3/16)
- 11/08 • • • with resilient bearings
- 11/10 • • Arrangements for locking
- 11/12 • • incorporating flexible connections, e.g. leaf springs
- 13/00 Rolls, drums, discs, or the like** (guide rollers in feeding webs B65H 27/00; calender rolls, bearings therefor D21G 1/02; rotary drums or rollers for heat-exchange or heat-transfer apparatus F28F 5/02; special adaptations, see the relevant classes); **Bearings or mountings therefor**
- 13/02 • Bearings
- 13/04 • • Bearings with only partial enclosure of the member to be borne; Bearings with local support at two or more points
- 13/06 • • self-adjusting
- 15/00 Construction of rotary bodies to resist centrifugal force** (flywheels, correction weights F16F 15/30, F16F 15/32)
- Bearings for rotary parts** (F16C 9/00, F16C 13/02 take precedence; allowing for linear movement also F16C 31/00)
- 17/00 Sliding-contact bearings for exclusively rotary movement** (F16C 32/06 takes precedence; adjustable bearings F16C 23/00, F16C 25/00) [2]
- 17/02 • for radial load only
- 17/03 • • with tiltably-supported segments, e.g. Michell bearings
- 17/04 • for axial load only
- 17/06 • • with tiltably-supported segments, e.g. Michell bearings
- 17/08 • • for supporting the end face of a shaft or other member, e.g. footstep bearings
- 17/10 • for both radial and axial load
- 17/12 • characterised by features not related to the direction of the load
- 17/14 • • specially adapted for operating in water
- 17/18 • • with floating brasses or bushes, rotatable at a reduced speed
- 17/20 • • with emergency supports or bearings
- 17/22 • • with arrangements compensating for thermal expansion
- 17/24 • • with devices affected by abnormal or undesired conditions, e.g. for preventing overheating, for safety
- 17/26 • Systems consisting of a plurality of sliding-contact bearings
- 19/00 Bearings with rolling contact, for exclusively rotary movement** (adjustable bearings F16C 23/00, F16C 25/00)
- 19/02 • with bearing balls essentially of the same size in one or more circular rows

- 19/04 • • for radial load mainly
  - 19/06 • • • with a single row of balls
  - 19/08 • • • with two or more rows of balls
  - 19/10 • • for axial load mainly
  - 19/12 • • • for supporting the end face of a shaft or other member, e.g. footstep bearings
  - 19/14 • • for both radial and axial load
  - 19/16 • • • with a single row of balls
  - 19/18 • • • with two or more rows of balls
  - 19/20 • • with loose spacing bodies, e.g. balls, between the bearing balls
  - 19/22 • with bearing rollers essentially of the same size in one or more circular rows, e.g. needle bearings
  - 19/24 • • for radial load mainly
  - 19/26 • • • with a single row of rollers
  - 19/28 • • • with two or more rows of rollers
  - 19/30 • • for axial load mainly
  - 19/32 • • • for supporting the end face of a shaft or other member, e.g. footstep bearings
  - 19/34 • • for both radial and axial load
  - 19/36 • • • with a single row of rollers
  - 19/38 • • • with two or more rows of rollers
  - 19/40 • • with loose spacing bodies between the rollers
  - 19/44 • • Needle bearings
  - 19/46 • • • with one row of needles
  - 19/48 • • • with two or more rows of needles
  - 19/49 • Bearings with both balls and rollers
  - 19/50 • Other types of ball or roller bearings
  - 19/52 • with devices affected by abnormal or undesired conditions
  - 19/54 • Systems consisting of a plurality of bearings with rolling friction (spindle bearings F16C 35/08)
  - 19/55 • • with intermediate floating rings rotating at reduced speed
  - 19/56 • • in which the rolling bodies of one bearing differ in diameter from those of another
  - 21/00 Combinations of sliding-contact bearings with ball or roller bearings, for exclusively rotary movement (F16C 17/24, F16C 19/52 take precedence) [2]**
  - 23/00 Bearings for exclusively rotary movement adjustable for aligning or positioning (F16C 27/00 takes precedence)**
    - 23/02 • Sliding-contact bearings
    - 23/04 • • self-adjusting
    - 23/06 • Ball or roller bearings
    - 23/08 • • self-adjusting
    - 23/10 • Bearings, parts of which are eccentrically adjustable with respect to each other
  - 25/00 Bearings for exclusively rotary movement adjustable for wear or play (F16C 27/00 takes precedence)**
    - 25/02 • Sliding-contact bearings
    - 25/04 • • self-adjusting
    - 25/06 • Ball or roller bearings
    - 25/08 • • self-adjusting
  - 27/00 Elastic or yielding bearings or bearing supports, for exclusively rotary movement (shock-damping bearings for watches or clocks G04B 31/02)**
    - 27/02 • Sliding-contact bearings
    - 27/04 • Ball or roller bearings, e.g. with resilient rolling bodies
    - 27/06 • • by means of parts of rubber or like materials (F16C 27/08 takes precedence; with sliding surfaces of rubber or synthetic rubber F16C 33/22)
    - 27/08 • primarily for axial load, e.g. for vertically-arranged shafts
    - 29/00 Bearings for parts moving only linearly (F16C 32/06 takes precedence; incorporated in flexible shafts F16C 1/28) [2]**
      - 29/02 • Sliding-contact bearings
      - 29/04 • Ball or roller bearings
      - 29/06 • • in which the rolling bodies circulate partly without carrying load
      - 29/08 • Arrangements for covering or protecting the ways
      - 29/10 • Arrangements for locking the bearings
      - 29/12 • Arrangements for adjusting play
    - 31/00 Bearings for parts which both rotate and move linearly**
      - 31/02 • Sliding-contact bearings
      - 31/04 • Ball or roller bearings
      - 31/06 • • in which the rolling bodies circulate partly without carrying load
    - 32/00 Bearings not otherwise provided for**
      - 32/02 • Knife-edge bearings
      - 32/04 • using magnetic or electric supporting means [2]
      - 32/06 • with moving member supported by a fluid cushion formed, at least to a large extent, otherwise than by movement of the shaft, e.g. hydrostatic air-cushion bearings [2]
- Details or accessories of bearings**
- 33/00 Parts of bearings; Special methods for making bearings or parts thereof (metal-working or like operations, see the relevant classes)**
    - 33/02 • Parts of sliding-contact bearings
    - 33/04 • • Brasses; Bushes; Linings
    - 33/06 • • • Sliding surface mainly made of metal (F16C 33/24-F16C 33/28 take precedence)
    - 33/08 • • • • Attachment of brasses, bushes, or linings to the bearing housing
    - 33/10 • • • • Construction relative to lubrication
    - 33/12 • • • • Structural composition; Use of special materials or surface treatments, e.g. for rust-proofing
    - 33/14 • • • • Special methods of manufacture; Running-in
    - 33/16 • • • Sliding surface consisting mainly of graphite
    - 33/18 • • • Sliding surface consisting mainly of wood or fibrous material
    - 33/20 • • • Sliding surface consisting mainly of plastics (F16C 33/22-F16C 33/28 take precedence)
    - 33/22 • • • Sliding surface consisting mainly of rubber or synthetic rubber (F16C 33/24-F16C 33/28 take precedence)
    - 33/24 • • • with different areas of the sliding surface consisting of different materials
    - 33/26 • • • made from wire coils; made from a number of discs, rings, rods, or other members
    - 33/28 • • • with embedded reinforcements shaped as frames or meshed materials
    - 33/30 • Parts of ball or roller bearings
    - 33/32 • • Balls
    - 33/34 • • Rollers; Needles

- 33/36 • • • with bearing-surfaces other than cylindrical, e.g. tapered; with grooves in the bearing surfaces
- 33/37 • • • Loose spacing bodies
- 33/372 • • • rigid
- 33/374 • • • resilient
- 33/38 • • • Ball cages
- 33/40 • • • for multiple rows of balls
- 33/41 • • • comb-shaped
- 33/42 • • • made from wire or sheet-metal strips (F16C 33/40, F16C 33/41 take precedence)
- 33/44 • • • Selection of substances (F16C 33/40, F16C 33/41 take precedence)
- 33/46 • • • Cages for rollers or needles
- 33/48 • • • for multiple rows of rollers or needles
- 33/49 • • • comb-shaped
- 33/50 • • • formed of interconnected members, e.g. chains
- 33/51 • • • formed of unconnected members
- 33/52 • • • with no part entering between, or touching, the bearing surfaces of the rollers (F16C 33/50 takes precedence)
- 33/54 • • • made from wire, strips, or sheet metal (F16C 33/48, F16C 33/49 take precedence)
- 33/56 • • • Selection of substances (F16C 33/48, F16C 33/49 take precedence)
- 33/58 • • • Raceways; Race rings
- 33/60 • • • divided
- 33/61 • • • • formed by wires
- 33/62 • • • Selection of substances
- 33/64 • • • Special methods of manufacture
- 33/66 • • • Special parts or details in view of lubrication
- 33/72 • Sealings
- 33/74 • • of sliding-contact bearings
- 33/76 • • of ball or roller bearings
- 33/78 • • • with a diaphragm, disc, or ring, with or without resilient members
- 33/80 • • • Labyrinth sealings
- 33/82 • • • Arrangements for electrostatic or magnetic action against dust or other particles
- 35/00 Rigid support of bearing units; Housings, e.g. caps, covers (F16C 23/00 takes precedence)**
- 35/02 • in the case of sliding-contact bearings
- 35/04 • in the case of ball or roller bearings
- 35/06 • • Mounting of ball or roller bearings; Fixing them onto shaft or in housing
- 35/063 • • • Fixing them on the shaft (with interposition of an element F16C 35/07) [3]
- 35/067 • • • Fixing them in a housing (with interposition of an element F16C 35/07) [3]
- 35/07 • • • Fixing them on the shaft or housing with interposition of an element [3]
- 35/073 • • • • between shaft and inner race ring [3]
- 35/077 • • • • between housing and outer race ring [3]
- 35/078 • • • using pressure fluid as mounting aid [3]
- 35/08 • for spindles
- 35/10 • • with sliding-contact bearings
- 35/12 • • with ball or roller bearings
- 37/00 Cooling of bearings**
- 39/00 Relieving load on bearings**
- 39/02 • using mechanical means
- 39/04 • using hydraulic or pneumatic means
- 39/06 • using magnetic means
- 41/00 Other accessories for bearings**
- 41/02 • Arrangements for equalising the load on a plurality of bearings or their elements
- 41/04 • Preventing damage to bearings during storage or transport thereof or when otherwise out of use
- 43/00 Assembling bearings**
- 43/02 • Assembling sliding-contact bearings
- 43/04 • Assembling rolling contact bearings
- 43/06 • • Placing rolling bodies in cages or bearings
- 43/08 • • • by deforming the cages or the races

**F16D COUPLINGS FOR TRANSMITTING ROTATION** (gearing for conveying rotation F16H, e.g. fluid gearing F16H 39/00-F16H 47/00); **CLUTCHES** (dynamo-electric clutches H02K 49/00; clutches using electrostatic attraction H02N 13/00); **BRAKES** (electrodynamic brake systems for vehicles in general B60L 7/00; dynamo-electric brakes H02K 49/00) [2]

### Subclass index

#### COUPLINGS

- In general.....1/00
- Yielding; impulse; slip.....3/00, 5/00, 7/00
- With safety members.....9/00
- Using a fluid as power-transmitting means.....31/00, 33/00, 39/00

#### CLUTCHES

- Mechanically actuated
  - the members being in direct contact.....11/00, 13/00, 17/00
  - with separate members.....15/00
  - others; combinations.....19/00, 21/00
  - details.....23/00
- Non-mechanically actuated
  - by fluid.....25/00, 29/00
  - magnetically actuated.....27/00, 29/00
  - electrically actuated.....28/00, 29/00
- Using a fluid as power-transmitting means.....31/00-37/00
- Freewheels, automatic.....41/00, 43/00, 45/00
- Combinations.....45/00, 47/00
- External control of clutches.....48/00

FREEWHEELS OR FREEWHEEL CLUTCHES..... 41/00, 45/00  
 BRAKES  
 Characterised by their function..... 49/00-55/00  
 Using resistance of liquid or air..... 57/00  
 Automatic..... 59/00  
 With means for making available for use the energy absorbed..... 61/00  
 Others..... 63/00  
 Details..... 65/00, 69/00, 71/00  
 Monitoring working conditions..... 66/00  
 COMBINATIONS OF DIFFERENT DEVICES..... 47/00, 67/00

**Couplings**

**1/00 Couplings for rigidly connecting two coaxial shafts or other movable machine elements** (for attachment of cranks to their shafts F16C 3/10)

- 1/02 • for connecting two abutting shafts or the like
- 1/027 • • non-disconnectable, e.g. involving gluing, welding or the like [6]
- 1/033 • • by clamping together two faces perpendicular to the axis of rotation, e.g. with bolted flanges [6]
- 1/04 • • with clamping hub; with hub and longitudinal key
- 1/05 • • • with radial clamping due to axial loading of at least one pair of conical surfaces [5]
- 1/06 • for attachment of a member on a shaft or on a shaft-end (attachment of marine propellers on shafts B63H 23/34)
- 1/064 • • non-disconnectable [6]
- 1/068 • • • involving gluing, welding or the like [6]
- 1/072 • • • involving plastic deformation (plastic welding F16D 1/068) [6]
- 1/076 • • by clamping together two faces perpendicular to the axis of rotation, e.g. with bolted flanges [6]
- 1/08 • • with clamping hub; with hub and longitudinal key
- 1/09 • • • with radial clamping due to axial loading of at least one pair of conical surfaces [5]
- 1/091 • • • • and comprising a chamber including a tapered piston moved axially by fluid pressure to effect clamping [2006.01]
- 1/092 • • • • the pair of conical mating surfaces being provided on the coupled hub and shaft [2006.01]
- 1/093 • • • • using one or more elastic or segmented conical rings forming at least one of the conical surfaces, the rings being expanded or contracted to effect clamping (F16D 1/091 takes precedence) [2006.01]
- 1/094 • • • • • using one or more pairs of elastic or segmented rings with mutually mating conical surfaces, one of the mating rings being contracted and the other being expanded [2006.01]
- 1/095 • • • • • with clamping effected by ring contraction only [2006.01]
- 1/096 • • • • • the ring or rings being located between the shaft and the hub [2006.01]
- 1/097 • • • • • with clamping effected by ring expansion only, e.g. with an expanded ring located between hub and shaft [2006.01]
- 1/10 • Quick-acting couplings in which the parts are connected by simply bringing them together axially
- 1/104 • • having retaining means rotating with the coupling and acting only by friction [6]

- 1/108 • • having retaining means rotating with the coupling and acting by interengaging parts, i.e. positive coupling [6]
- 1/112 • • • the interengaging parts comprising torque-transmitting surfaces, e.g. bayonet joints [6]
- 1/116 • • • the interengaging parts including a continuous or interrupted circumferential groove in the surface of one of the coupling parts (circlips for retaining hubs on shafts F16B 21/18) [6]
- 1/12 • allowing adjustment of the parts about the axis (during motion F16D 3/10)
- 3/00 Yielding couplings, i.e. with means permitting movement between the connected parts during the drive** (couplings disconnectable simply by axial movement F16D 1/10; slip couplings F16D 7/00; fluid couplings F16D 31/00-F16D 39/00)
- 3/02 • adapted to specific functions (universal joints, see the appropriate groups)
- 3/04 • • specially adapted to allow radial displacement, e.g. Oldham couplings
- 3/06 • • specially adapted to allow axial displacement
- 3/08 • • Couplings for intersecting shafts, provided with intermediate bars bent in an angle corresponding with the angle of intersection
- 3/10 • • Couplings with means for varying the angular relationship of two coaxial shafts during motion
- 3/12 • • specially adapted for accumulation of energy to absorb shocks or vibration (by making use of fluid elements F16D 3/80)
- 3/14 • • combined with a friction coupling for damping vibration or absorbing shock
- 3/16 • Universal joints in which flexibility is produced by means of pivots or sliding or rolling connecting parts
- 3/18 • • the coupling parts having slidably-interengaging teeth

**Note(s)**

In this group, the following expression is used with the meaning indicated:

- "coupling parts" means the driving member and the driven member of the coupling, which are mounted on, and rotate as a unit with, the shafts or their equivalents between which the coupling is placed. An intermediate member interconnecting these parts is regarded as such an equivalent.
- 3/19 • • • of resilient material or structure
- 3/20 • • one coupling part entering a sleeve of the other coupling part and connected thereto by sliding or rolling members (F16D 3/18, F16D 3/24 take precedence) [4, 5]
- 3/202 • • one coupling part having radially projecting pins, e.g. tripod joints [5]

- 3/205 • • • • the pins extending radially outwardly from the coupling part [5]
- 3/207 • • • • the pins extending radially inwardly from the coupling part [5]
- 3/22 • • • • the rolling members being balls, rollers, or the like, guided in grooves or sockets in both coupling parts [3, 5]
- 3/221 • • • • the rolling members being located in sockets in one of the coupling parts [5]
- 3/223 • • • • the rolling members being guided in grooves in both coupling parts [5, 2011.01]
- 3/2233 • • • • • where the track is made up of two curves with a point of inflexion in between, i.e. S-track joints [2011.01]
- 3/2237 • • • • • where the grooves are composed of radii and adjoining straight lines, i.e. undercut free [UF] type joints [2011.01]
- 3/224 • • • • • the groove centre-lines of each coupling part lying on a sphere [5, 2011.01]
- 3/2245 • • • • • • where the groove centres are offset from the joint centre [2011.01]
- 3/226 • • • • • the groove centre-lines of each coupling part lying on a cylinder co-axial with the respective coupling part [5]
- 3/227 • • • • • • the joints being telescopic [5]
- 3/229 • • • • • Prismatic coupling parts having each groove centre-line lying on planes parallel to the axis of the respective coupling part (F16D 3/224, F16D 3/226 take precedence) [5]
- 3/24 • • • comprising balls, rollers, or the like, between overlapping driving faces, e.g. cogs, on both coupling parts [3, 5]
- 3/26 • • • Hooke's joints or other joints with an equivalent intermediate member to which each coupling part is pivotally or slideably connected (F16D 3/18, F16D 3/20 take precedence)
- 3/27 • • • • with two or more intermediate members pivotally or slidably connected together, e.g. tongue-and-slipper type joints [5]
- 3/28 • • • • in which the interconnecting pivots include elastic members
- 3/30 • • • • in which the coupling is specially adapted to constant velocity-ratio
- 3/32 • • • • • by the provision of two intermediate members each having two relatively-perpendicular trunnions or bearings
- 3/33 • • • • • • with ball or roller bearings
- 3/34 • • • • • parts being connected by ridges, pins, balls, or the like guided in grooves or between cogs
- 3/36 • • • • in which each pivot between the coupling parts and the intermediate member comprises a single ball
- 3/38 • • • • with a single intermediate member with trunnions or bearings arranged on two axes perpendicular to one another (F16D 3/36 takes precedence)
- 3/40 • • • • • with intermediate member provided with two pairs of outwardly-directed trunnions on intersecting axes
- 3/41 • • • • • • with ball or roller bearings
- 3/42 • • • • • with ring-shaped intermediate member provided with bearings or inwardly-directed trunnions
- 3/43 • • • • • • with ball or roller bearings
- 3/44 • • • • the intermediate member being connected to the coupling parts by ridges, pins, balls, or the like guided in grooves or between cogs
- 3/46 • • • • • each coupling part embracing grooves or ridges on the intermediate member
- 3/48 • • • one coupling part having pins arranged parallel to the axis and entering holes in the other coupling part
- 3/50 • • with the coupling parts connected by one or more intermediate members (F16D 3/16 takes precedence)
- 3/52 • • • comprising a continuous strip, spring, or the like engaging the coupling parts at a number of places
- 3/54 • • • Couplings comprising a chain or strip surrounding two wheels arranged side by side and provided with teeth or the equivalent
- 3/56 • • • comprising elastic metal lamellae, elastic rods, or the like, e.g. arranged radially or parallel to the axis, the members being shear-loaded collectively by the total load
- 3/58 • • • • the intermediate members being made of rubber or like material
- 3/60 • • • comprising pushing or pulling links attached to both parts (F16D 3/64 takes precedence)
- 3/62 • • • • the links or their attachments being elastic
- 3/64 • • • comprising elastic elements arranged between substantially-radial walls of both coupling parts
- 3/66 • • • • the elements being metallic, e.g. in the form of coils
- 3/68 • • • • the elements being made of rubber or similar material
- 3/70 • • • comprising elastic elements arranged in holes in one coupling part and surrounding pins on the other coupling part
- 3/72 • • • with axially-spaced attachments to the coupling parts (F16D 3/56 takes precedence)
- 3/74 • • • • the intermediate member or members being made of rubber or other flexible material
- 3/76 • • • shaped as an elastic ring centered on the axis, surrounding a portion of one coupling part and surrounded by a sleeve of the other coupling part
- 3/77 • • • • the ring being metallic
- 3/78 • • • shaped as an elastic disc or flat ring, arranged perpendicular to the axis of the coupling parts, different sets of spots of the disc or ring being attached to each coupling part, e.g. Hardy couplings
- 3/79 • • • • the disc or ring being metallic
- 3/80 • • in which a fluid is used (fluid couplings allowing continuous slip F16D 31/00-F16D 35/00)
- 3/82 • • • with a coupling element in the form of a pneumatic tube
- 3/84 • • Shrouds, e.g. casings, covers; Sealing means specially adapted therefor
- 5/00 **Impulse couplings, i.e. couplings that alternately accelerate and decelerate the driven member** (fluid couplings F16D 31/00-F16D 39/00)
- 7/00 **Slip couplings, e.g. slipping on overload, for absorbing shock** (combined with yielding shaft couplings F16D 3/14; fluid slip couplings F16D 31/00-F16D 35/00)
- 7/02 • • of the friction type (couplings in which overload initiates a decrease of coupling pressure or a disconnection, see the relevant groups for clutches)
- 7/04 • • of the ratchet type
- 7/06 • • • with intermediate balls or rollers

## F16D

- 7/08 • • • moving axially between engagement and disengagement [5]
- 7/10 • • • moving radially between engagement and disengagement [5]
- 9/00 Couplings with safety member for disconnecting**
- 9/02 • by thermal means, e.g. melting member [6]
- 9/04 • by tensile breaking [6]
- 9/06 • by breaking due to shear stress [6]
- 9/08 • • over a single area encircling the axis of rotation, e.g. shear necks on shafts (F16D 9/10 takes precedence) [6]
- 9/10 • • having a part movable after disconnection so as to provide reconnection, e.g. advanceable shear pins [6]

### Clutches with mechanically-actuated clutching members: Synchronisation arrangements for clutches

#### **11/00 Clutches in which the members have interengaging parts** (arrangements for synchronisation F16D 23/02; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)

- 11/02 • disengaged by a contact of a part mounted on the clutch with a stationarily-mounted member
- 11/04 • • with clutching members movable only axially
- 11/06 • • with clutching members movable otherwise than only axially, e.g. rotatable keys
- 11/08 • actuated by moving a non-rotating part axially (actuating-mechanisms in the relevant groups)
- 11/10 • • with clutching members movable only axially
- 11/12 • • with clutching members movable otherwise than only axially
- 11/14 • with clutching members movable only axially (F16D 11/02, F16D 11/08 take precedence) [5]
- 11/16 • with clutching members movable otherwise than only axially (F16D 11/02, F16D 11/08 take precedence) [5]

#### **13/00 Friction clutches** (arrangements for synchronisation F16D 23/02; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)

- 13/02 • disengaged by the contact of a part mounted on the clutch with a stationarily-mounted member
- 13/04 • with means for actuating or keeping engaged by a force derived at least partially from one of the shafts to be connected (automatic clutches F16D 43/00)
- 13/06 • • with clutching members movable otherwise than only axially (F16D 13/08, F16D 13/12 take precedence)
- 13/08 • with a helical band or equivalent member, which may be built-up from linked parts, with more than one turn embracing a drum or the like, with or without an additional clutch actuating the end of the band (F16D 13/02 takes precedence)
- 13/10 • with clutching members co-operating with the periphery of a drum, a wheel-rim, or the like (F16D 13/02-F16D 13/08 take precedence)
- 13/12 • with an expansible band or coil co-operating with the inner surface of a drum or the like (F16D 13/02 takes precedence)
- 13/14 • with outwardly-movable clutching members co-operating with the inner surface of a drum or the like (F16D 13/02, F16D 13/06, F16D 13/12 take precedence)
- 13/16 • • shaped as radially-movable segments
- 13/18 • • shaped as linked or separately-pivoted segments

- 13/20 • with clutching members co-operating with both the periphery and the inner surface of a drum or wheel-rim
- 13/22 • with axially-movable clutching members
- 13/24 • • with conical friction surfaces
- 13/26 • • • in which the or each axially-movable member is pressed exclusively against an axially-located member
- 13/28 • • • • with means for increasing the effective force between the actuating sleeve or equivalent member and the pressure member
- 13/30 • • • • • in which the clutching pressure is produced by springs only
- 13/32 • • • in which two or more axially-movable members are pressed from one side towards an axially-located member
- 13/34 • • • • with means for increasing the effective force between the actuating sleeve or equivalent member and the pressure member
- 13/36 • • • • • in which the clutching pressure is produced by springs only
- 13/38 • • with flat clutching surfaces, e.g. discs
- 13/40 • • • in which the or each axially-movable member is pressed exclusively against an axially-located member
- 13/42 • • • • with means for increasing the effective force between the actuating sleeve or equivalent member and the pressure member
- 13/44 • • • • • in which the clutching pressure is produced by springs only
- 13/46 • • • in which two axially-movable members, of which one is attached to the driving side and the other to the driven side, are pressed from one side towards an axially-located member
- 13/48 • • • • with means for increasing the effective force between the actuating sleeve or equivalent member and the pressure member
- 13/50 • • • • • in which the clutching pressure is produced by springs only
- 13/52 • • • Clutches with multiple lamellae
- 13/54 • • • • with means for increasing the effective force between the actuating sleeve or equivalent member and the pressure member
- 13/56 • • • • • in which the clutching pressure is produced by springs only
- 13/58 • Details
- 13/60 • • Clutching elements (friction lining or attachment thereof F16D 69/00)
- 13/62 • • • Clutch-bands; Clutch-shoes; Clutch-drums (brake-bands, brake-shoes, brake-drums F16D 65/00)
- 13/64 • • • Clutch-plates; Clutch-lamellae (brake-plates, brake-lamellae F16D 65/12)
- 13/66 • • • • of conical shape
- 13/68 • • • • Attachments of plates or lamellae to their supports
- 13/69 • • • • Arrangements for spreading lamellae in released state
- 13/70 • • Pressure members, e.g. pressure plates, for clutch-plates or lamellae; Guiding arrangements for pressure members
- 13/71 • • • in which the clutching pressure is produced by springs only
- 13/72 • • Features relating to cooling
- 13/74 • • Features relating to lubrication
- 13/75 • • Features relating to adjustment, e.g. slack adjusters

- 13/76 • specially adapted to incorporate with other transmission parts, i.e. at least one of the clutch parts also having another function, e.g. being the disc of a pulley
- 15/00 Clutches with wedging balls or rollers or with other wedgeable separate clutching members** (freewheels, freewheel clutches F16D 41/00; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)
- 17/00 Clutches in which the drive is transmitted solely by virtue of the eccentricity of the contacting surfaces of clutch members which fit one around the other** (automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)
- 19/00 Clutches with mechanically-actuated clutching members not otherwise provided for** (automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)
- 21/00 Systems comprising a plurality of mechanically-actuated clutches** (for synchronisation F16D 23/04; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)
- 21/02 • for interconnecting three or more shafts or other transmission members in different ways
- 21/04 • • with a shaft carrying a number of rotatable transmission members, e.g. gears, each of which can be connected to the shaft by a clutching member or members between the shaft and the hub of the transmission member
- 21/06 • • at least two driving shafts or two driven shafts being concentric
- 21/08 • Serially-arranged clutches interconnecting two shafts only when all the clutches are engaged (F16D 13/08, F16D 13/12 take precedence)
- 23/00 Details of mechanically-actuated clutches not specific for one distinct type; Synchronisation arrangements for clutches**
- 23/02 • Arrangements for synchronisation (shape or mounting of interengaging parts of clutch members to facilitate engagement F16D 11/08)
- 23/04 • • with an additional friction clutch
- 23/06 • • • and a blocking mechanism preventing the engagement of the main clutch prior to synchronisation
- 23/08 • • with a blocking mechanism that only releases the clutching member on synchronisation (in combination with an additional friction clutch F16D 23/06)
- 23/10 • • automatically producing the engagement of the clutch when the clutch members are moving at the same speed; Indicating synchronisation
- 23/12 • Mechanical clutch-actuating mechanisms arranged outside the clutch as such (specific for combined clutches F16D 21/00; mechanisms specific for synchronisation F16D 23/02)
- 23/14 • • Clutch-actuating sleeves; Actuating members directly connected to clutch-actuating sleeves
- Clutches actuated non-mechanically [3]**
- 25/00 Fluid-actuated clutches** (arrangements for synchronisation F16D 23/02; fluid clutches F16D 31/00-F16D 39/00; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00)
- 25/02 • with means for actuating or keeping engaged by a force derived at least partially from one of the shafts to be connected
- 25/04 • in which the fluid actuates an elastic clutching member, e.g. a diaphragm or a pneumatic tube (F16D 25/02 takes precedence; coupling using a pneumatic tube F16D 3/82)
- 25/06 • in which the fluid actuates a piston incorporated in the clutch (F16D 25/02 takes precedence)
- 25/061 • • the clutch having interengaging clutch members
- 25/062 • • the clutch having friction surfaces
- 25/063 • • • with clutch members exclusively moving axially
- 25/0632 • • • • with conical friction surfaces, e.g. cone clutches [5]
- 25/0635 • • • • with flat friction surfaces, e.g. discs [5]
- 25/0638 • • • • • with more than two discs, e.g. multiple lamellae [5]
- 25/064 • • • • the friction surface being grooved
- 25/065 • • • • with clutching members having a movement which has at least a radial component
- 25/08 • with fluid-actuated member not rotating with a clutching member (F16D 25/02 takes precedence)
- 25/10 • Clutch systems with a plurality of fluid-actuated clutches
- 25/12 • Details not specific to one of the before-mentioned types
- 27/00 Magnetically-actuated clutches; Control or electric circuits therefor** (arrangements for synchronisation F16D 23/02; clutches with magnetisable particles F16D 37/02; automatic clutches F16D 43/00-F16D 45/00; circuits for external control F16D 48/00) [2]
- 27/01 • with permanent magnets
- 27/02 • with electromagnets incorporated in the clutch, i.e. with collecting rings
- 27/04 • • with axially-movable friction surfaces
- 27/06 • • • with friction surfaces arranged within the flux
- 27/07 • • • • Constructional features of clutch-plates or clutch-lamellae
- 27/08 • • • with friction surfaces arranged externally to the flux
- 27/09 • • and with interengaging jaws or gear-teeth
- 27/10 • with an electromagnet not rotating with a clutching member, i.e. without collecting rings
- 27/102 • • with radially movable clutching members (F16D 27/105 takes precedence) [5]
- 27/105 • • with a helical band or equivalent member co-operating with a cylindrical coupling surface [5]
- 27/108 • • with axially movable clutching members [5]
- 27/11 • • • with conical friction surfaces, e.g. cone clutches [5]
- 27/112 • • • with flat friction surfaces, e.g. discs [5]
- 27/115 • • • • with more than two discs, e.g. multiple lamellae [5]
- 27/118 • • with interengaging jaws or gear teeth [5]
- 27/12 • Clutch systems with a plurality of electromagnetically-actuated clutches
- 27/14 • Details
- 28/00 Electrically-actuated clutches** (arrangements for synchronisation F16D 23/02; clutches actuated directly by means of an electromagnet F16D 27/00; automatic clutches F16D 43/00-F16D 45/00; external control F16D 48/00) [6]

**29/00 Clutches or systems of clutches involving both fluid and magnetic or both fluid and electric actuation [6]****Couplings or clutches with a fluid or semifluid as power-transmitting means****31/00 Fluid couplings or clutches with pumping sets of the volumetric type, i.e. in the case of liquid passing a predetermined volume per revolution**

- 31/02 • using pumps with pistons or plungers working in cylinders
- 31/04 • using gear-pumps
- 31/06 • using pumps of types differing from those before-mentioned
- 31/08 • Control of slip

**33/00 Rotary fluid couplings or clutches of the hydrokinetic type**

- 33/02 • controlled by changing the flow of the liquid in the working circuit, while maintaining a completely filled working circuit
- 33/04 • • by altering the position of blades
- 33/06 • controlled by changing the amount of liquid in the working circuit
- 33/08 • • by devices incorporated in the fluid coupling, with or without remote control
- 33/10 • • • consisting of controllable supply and discharge openings
- 33/12 • • • • controlled automatically by self-actuated valves
- 33/14 • • • consisting of shiftable or adjustable scoops
- 33/16 • • by means arranged externally of the coupling or clutch
- 33/18 • Details
- 33/20 • • Shape of wheels, blades, or channels with respect to function

**35/00 Fluid clutches in which the clutching is predominantly obtained by fluid adhesion (F16D 37/00 takes precedence)**

- 35/02 • with rotary working chambers and rotary reservoirs, e.g. in one coupling part [5]

**37/00 Clutches in which the drive is transmitted through a medium consisting of small particles, e.g. centrifugally speed-responsive**

- 37/02 • the particles being magnetisable

**39/00 Combinations of couplings according to two or more of the groups F16D 31/00-F16D 37/00****Freewheels or freewheel clutches; Automatic clutches****Note(s) [2009.01]**

Groups F16D 31/00-F16D 39/00 take precedence over groups F16D 41/00-F16D 45/00.

**41/00 Freewheels or freewheel clutches (cycle brakes controlled by back-peddalling B62L 5/00)**

- 41/02 • disengaged by contact of a part of or on the freewheel or freewheel clutch with a stationarily-mounted member
- 41/04 • combined with a clutch for locking the driving and driven members (F16D 41/02, F16D 41/24 take precedence)

- 41/06 • with intermediate wedging coupling members between an inner and an outer surface (F16D 41/02, F16D 41/24 take precedence)

- 41/061 • • the intermediate members wedging by movement having an axial component [6]

- 41/063 • • the intermediate members wedging by moving along the inner and the outer surface without pivoting or rolling, e.g. sliding wedges (F16D 41/061 takes precedence) [6]

- 41/064 • • the intermediate members wedging by rolling and having a circular cross-section, e.g. balls (F16D 41/061 takes precedence) [6]

- 41/066 • • • all members having the same size and only one of the two surfaces being cylindrical [6]

- 41/067 • • • • and the members being distributed by a separate cage encircling the axis of rotation [6]

- 41/069 • • the intermediate members wedging by pivoting or rocking, e.g. sprags (F16D 41/061 takes precedence) [6]

- 41/07 • • • between two cylindrical surfaces [6]

- 41/08 • • with provision for altering the freewheeling action

- 41/10 • • • with self-actuated reversing

- 41/12 • with hinged pawl co-operating with teeth, cogs, or the like (F16D 41/02, F16D 41/24 take precedence)

- 41/14 • • the effective stroke of the pawl being adjustable

- 41/16 • • the action being reversible

- 41/18 • with non-hinged detent (F16D 41/02, F16D 41/24 take precedence)

- 41/20 • with expandable or contractable clamping ring or band (F16D 41/02, F16D 41/24 take precedence)

- 41/22 • with clutching ring or disc axially shifted as a result of lost motion between actuating members (F16D 41/02, F16D 41/24 take precedence)

- 41/24 • specially adapted for cycles

- 41/26 • • with provision for altering the action

- 41/28 • • with intermediate wedging coupling members

- 41/30 • • with hinged pawl co-operating with teeth, cogs, or the like

- 41/32 • • with non-hinged detent

- 41/34 • • with expandable or contractable clamping ring or band

- 41/36 • • with clutching ring or disc axially shifted as a result of lost motion between actuating members

**43/00 Internally controlled automatic clutches (freewheels, freewheel clutches F16D 41/00; external control of clutches F16D 48/00) [6]**

- 43/02 • actuated entirely mechanically

- 43/04 • • controlled by angular speed (F16D 43/24 takes precedence; clutches in which the drive is transmitted through a medium consisting of small particles F16D 37/00)

- 43/06 • • • with centrifugal masses actuating axially a movable pressure ring or the like

- 43/08 • • • • the pressure ring actuating friction plates, cones, or similar axially-movable friction surfaces

- 43/09 • • • • • in which the carrier of the centrifugal masses can be stopped

- 43/10 • • • • • the centrifugal masses acting directly on the pressure ring, no other actuating mechanism for the pressure ring being provided

- 43/12 • • • • • the centrifugal masses acting on, or forming a part of, an actuating mechanism by which the pressure ring can also be actuated independently of the masses
- 43/14 • • • with centrifugal masses actuating the clutching members directly in a direction which has at least a radial component; with centrifugal masses themselves being the clutching members
- 43/16 • • • • • with clutching members having interengaging parts
- 43/18 • • • • • with friction clutching members
- 43/20 • • • controlled by torque, e.g. overload-release clutches, slip-clutches with means by which torque varies the clutching pressure
- 43/202 • • • of the ratchet type (slip couplings of the ratchet type F16D 7/04) [5]
- 43/204 • • • • • with intermediate balls or rollers [5]
- 43/206 • • • • • moving axially between engagement and disengagement [5]
- 43/208 • • • • • moving radially between engagement and disengagement [5]
- 43/21 • • • • • with friction members
- 43/22 • • • controlled by both speed and torque
- 43/24 • • • controlled by acceleration or deceleration of angular speed
- 43/25 • • • controlled by thermo-responsive elements
- 43/26 • • • acting at definite angular position or disengaging after a definite number of rotations (actuating by means of stationary abutment F16D 11/02, F16D 13/02, F16D 15/00)
- 43/28 • • actuated by fluid pressure
- 43/284 • • • controlled by angular speed
- 43/286 • • • controlled by torque
- 43/30 • • Systems of a plurality of automatic clutches
- 45/00 Freewheels or freewheel clutches combined with automatic clutches**
- 
- 47/00 Systems of clutches, or clutches and couplings, comprising devices of types grouped under at least two of the following sets of groups: F16D 1/00-F16D 9/00; F16D 11/00-F16D 23/00; F16D 25/00-F16D 29/00; F16D 31/00-F16D 39/00; F16D 41/00-F16D 45/00** (freewheels combined with a clutch to lock the driving and driven members of the freewheel F16D 41/04, F16D 41/26)
- 47/02 • • of which at least one is a coupling (elastic attachment of clutch parts, see the relevant groups for clutches)
- 47/04 • • of which at least one is a freewheel (F16D 47/02, F16D 47/06 take precedence)
- 47/06 • • of which at least one is a clutch with a fluid or a semifluid as power-transmitting means
- 48/00 External control of clutches [6]**
- Note(s)**
- This group does not cover actuation, which is covered by groups F16D 11/00-F16D 29/00.
- 48/02 • • Control by fluid pressure [6]
- 48/04 • • • providing power assistance [6]
- 48/06 • • Control by electric or electronic means, e.g. of fluid pressure [6]
- 48/08 • • • Regulating clutch take-up on starting [6]
- 48/10 • • • Preventing unintentional or unsafe engagement [6]
- 48/12 • • • Control of torque transfer between driven axles [6]
- Brakes**
- 49/00 Brakes with a braking member co-operating with the periphery of a drum, wheel-rim, or the like**
- 49/02 • • shaped as a helical band or coil with more than one turn, with or without intensification of the braking force by the tension of the band or contracting member
- 49/04 • • • mechanically actuated
- 49/06 • • • fluid actuated
- 49/08 • • shaped as an encircling band extending over approximately 360°
- 49/10 • • • mechanically actuated (self-tightening F16D 49/20)
- 49/12 • • • fluid actuated
- 49/14 • • shaped as a fluid-filled flexible member actuated by variation of the fluid pressure
- 49/16 • • Brakes with two brake-blocks (self-tightening F16D 49/20)
- 49/18 • • Brakes with three or more brake-blocks (self-tightening F16D 49/20)
- 49/20 • • Self-tightening brakes (with helical band or coil with more than one turn F16D 49/02)
- 49/22 • • • with an auxiliary friction member initiating or increasing the action of the brake
- 51/00 Brakes with outwardly-movable braking members co-operating with the inner surface of a drum or the like**
- 51/02 • • shaped as one or more circumferential bands
- 51/04 • • • mechanically actuated
- 51/06 • • • fluid actuated
- 51/08 • • shaped as an expansible fluid-filled flexible member
- 51/10 • • shaped as exclusively radially-movable brake-shoes
- 51/12 • • • mechanically actuated
- 51/14 • • • fluid actuated
- 51/16 • • shaped as brake-shoes pivoted on a fixed or nearly-fixed axis (self-tightening F16D 51/46)
- 51/18 • • • with two brake-shoes
- 51/20 • • • extending in opposite directions from their pivots
- 51/22 • • • • • mechanically actuated
- 51/24 • • • • • fluid actuated
- 51/26 • • • • • both extending in the same direction from their pivots
- 51/28 • • • • • mechanically actuated
- 51/30 • • • • • fluid actuated
- 51/32 • • • with three or more brake-shoes
- 51/34 • • • • • extending in opposite directions from their pivots
- 51/36 • • • • • mechanically actuated
- 51/38 • • • • • fluid actuated
- 51/40 • • • • • all extending in the same direction from their pivots
- 51/42 • • • • • mechanically actuated
- 51/44 • • • • • fluid actuated
- 51/46 • • Self-tightening brakes with pivoted brake-shoes
- 51/48 • • • with two linked or directly-interacting brake-shoes
- 51/50 • • • • • mechanically actuated
- 51/52 • • • • • fluid actuated
- 51/54 • • • with three or more brake-shoes, at least two of them being linked or directly interacting
- 51/56 • • • • • mechanically actuated

## F16D

- 51/58 • • • fluid actuated
- 51/60 • • with wedging action of a brake-shoe, e.g. the shoe entering as a wedge between the brake-drum and a stationary part
- 51/62 • • • mechanically actuated
- 51/64 • • • fluid actuated
- 51/66 • • an actuated brake-shoe being carried along and thereby engaging a member for actuating another brake-shoe
- 51/68 • • • mechanically actuated
- 51/70 • • • fluid actuated
- 53/00 Brakes with braking members co-operating with both the periphery and the inner surface of a drum, wheel-rim, or the like**
- 55/00 Brakes with substantially-radial braking surfaces pressed together in axial direction, e.g. disc brakes**
- 55/02 • with axially-movable discs or pads pressed against axially-located rotating members
- 55/04 • • by moving discs or pads away from one another against radial walls of drums or cylinders
- 55/06 • • • without self-tightening action
- 55/08 • • • • Mechanically-actuated brakes
- 55/10 • • • • Brakes actuated by a fluid-pressure device arranged in or on the brake
- 55/12 • • • • • comprising an expansible fluid-filled flexible member coaxial with the brake
- 55/14 • • • with self-tightening action, e.g. by means of coating helical surfaces or balls and inclined surfaces
- 55/15 • • • • initiated by means of brake-bands or brake-shoes
- 55/16 • • • • Mechanically-actuated brakes
- 55/18 • • • • Brakes actuated by a fluid-pressure device arranged in or on the brake
- 55/20 • • • • • comprising an expansible fluid-filled flexible member coaxial with the brake
- 55/22 • • by clamping an axially-located rotating disc between movable braking members, e.g. movable brake discs or brake pads [5]
- 55/224 • • • with a common actuating member for the braking members [5]
- 55/225 • • • • the braking members being brake pads [5]
- 55/2255 • • • • • in which the common actuating member is pivoted [5]
- 55/226 • • • • • in which the common actuating member is moved axially [5]
- 55/2265 • • • • • • the axial movement being guided by one or more pins [5]
- 55/227 • • • • • • • by two pins [5]
- 55/228 • • • with a separate actuating member for each side
- 55/24 • with a plurality of axially-movable discs, lamellae, or pads, pressed from one side towards an axially-located member
- 55/26 • • without self-tightening action
- 55/28 • • • Brakes with only one rotating disc
- 55/30 • • • • mechanically actuated
- 55/31 • • • • • by means of an intermediate leverage
- 55/32 • • • • • actuated by a fluid-pressure device arranged in or on the brake
- 55/33 • • • • • by means of an intermediate leverage
- 55/34 • • • • • comprising an expansible fluid-filled flexible member coaxial with the brake
- 55/36 • • • Brakes with a plurality of rotating discs all lying side by side
- 55/38 • • • • mechanically actuated
- 55/39 • • • • • by means of an intermediate leverage
- 55/40 • • • • • actuated by a fluid-pressure device arranged in or on the brake
- 55/41 • • • • • by means of an intermediate leverage
- 55/42 • • • • • comprising an expansible fluid-filled flexible member coaxial with the brake
- 55/44 • • • with the rotating part consisting of both central plates and ring-shaped plates arranged concentrically around the central plates
- 55/46 • • with self-tightening action
- 55/48 • • • with discs or pads having a small free angular travel relative to their support, which produces the self-tightening action
- 55/50 • • • with auxiliary friction members, which may be of different type, producing the self-tightening action
- 57/00 Liquid-resistance brakes; Air-resistance brakes**
- 57/02 • with blades or like members braked by the fluid
- 57/04 • with blades causing a directed flow, e.g. Föttinger type
- 57/06 • comprising a pump circulating fluid, braking being effected by throttling of the circulation
- 59/00 Self-acting brakes, e.g. coming into operation at a predetermined speed**
- 59/02 • spring-loaded and adapted to be released by mechanical, fluid, or electromagnetic means
- 61/00 Brakes with means for making the energy absorbed available for use (F16D 57/00 takes precedence)**
- 63/00 Brakes not otherwise provided for; Brakes combining more than one of the types of groups F16D 49/00-F16D 61/00 (brakes with auxiliary members for self-tightening F16D 49/22, F16D 51/66, F16D 55/50)**
- 65/00 Parts or details of brakes**
- 65/02 • Braking members; Mounting thereof (friction linings or attachment thereof F16D 69/00)
- 65/04 • • Bands, shoes or pads; Pivots or supporting members therefor [5]
- 65/06 • • • for externally-engaging brakes
- 65/08 • • • for internally-engaging brakes
- 65/09 • • • • Pivots or supporting members therefor [2]
- 65/092 • • • for axially-engaging brakes, e.g. disc brakes [5]
- 65/095 • • • • Pivots or supporting members therefor [5]
- 65/097 • • • • • Resilient means interposed between pads and supporting members [5]
- 65/10 • • Drums for externally- or internally-engaging brakes
- 65/12 • • Discs; Drums for disc brakes
- 65/14 • Actuating mechanisms for brakes; Means for initiating operation at a predetermined position (brake control systems, parts thereof B60T)
- Note(s) [2012.01]**
- In this group, it is desirable to add the indexing codes of groups F16D 121/00-F16D 131/00 relating to actuators.*
- 65/16 • • arranged in or on the brake
- 65/18 • • • adapted for drawing members together
- 65/22 • • • adapted for pressing members apart
- 65/28 • • arranged apart from the brake
- 65/38 • Slack adjusters

- 65/40 • • mechanical
- 65/42 • • • non-automatic
- 65/44 • • • • by means of direct linear adjustment (F16D 65/46, F16D 65/48 take precedence)
- 65/46 • • • • with screw-thread and nut
- 65/48 • • • • with eccentric or helical body
- 65/50 • • • • for angular adjustment of two concentric parts of the brake control system
- 65/52 • • • self-acting in one direction for adjusting excessive play
- 65/54 • • • • by means of direct linear adjustment (F16D 65/56, F16D 65/58 take precedence)
- 65/56 • • • • with screw-thread and nut
- 65/58 • • • • with eccentric or helical body
- 65/60 • • • • for angular adjustment of two concentric parts of the brake control system
- 65/62 • • • self-acting in both directions for adjusting excessive and insufficient play
- 65/64 • • • • by means of direct linear adjustment (F16D 65/66, F16D 65/68 take precedence)
- 65/66 • • • • with screw-thread and nut
- 65/68 • • • • with eccentric or helical body
- 65/70 • • • • for angular adjustment of two concentric parts of the brake control system
- 65/72 • • hydraulic
- 65/74 • • • self-acting in one direction
- 65/76 • • • self-acting in both directions
- 65/78 • Features relating to cooling
- 65/80 • • for externally-engaging brakes
- 65/807 • • • with open cooling system, e.g. cooled by air [2]
- 65/813 • • • with closed cooling system [2]
- 65/82 • • for internally-engaging brakes
- 65/827 • • • with open cooling system, e.g. cooled by air [2]
- 65/833 • • • with closed cooling system [2]
- 65/84 • • for disc brakes
- 65/847 • • • with open cooling system, e.g. cooled by air [2]
- 65/853 • • • with closed cooling system [2]

**66/00 Arrangements for monitoring working conditions of brakes, e.g. wear or temperature**

- 66/02 • Apparatus for indicating wear

**67/00 Combinations of couplings and brakes; Combinations of clutches and brakes**

(F16D 71/00 takes precedence; conjoint control of brake systems and driveline clutches in vehicles B60W 10/02, B60W 10/18) [2]

- 67/02 • Clutch-brake combinations
- 67/04 • • fluid actuated
- 67/06 • • electromagnetically actuated

**69/00 Friction linings; Attachment thereof; Selection of coating friction substances or surfaces** (braking members F16D 65/02)

- 69/02 • Composition of linings (chemical aspects, see the relevant classes)
- 69/04 • Attachment of linings

**71/00 Mechanisms for bringing members to rest in a predetermined position** (combined with, or controlling, clutches F16D 43/26; means for initiating operation of brakes at a predetermined position F16D 65/14)

- 71/02 • comprising auxiliary means for producing the final movement

- 71/04 • providing for selection between a plurality of positions (F16D 71/02 takes precedence)

**Indexing scheme associated with groups F16D 65/14-F16D 65/28 relating to actuators [2012.01]**

- 121/00 Type of actuator operation force [2012.01]**
- 121/02 • Fluid pressure [2012.01]
- 121/04 • • acting on a piston-type actuator, e.g. for liquid pressure [2012.01]
- 121/06 • • • for releasing a normally applied brake [2012.01]
- 121/08 • • acting on a membrane-type actuator, e.g. for gas pressure [2012.01]
- 121/10 • • • for releasing a normally applied brake [2012.01]
- 121/12 • • for releasing a normally applied brake, the type of actuator being irrelevant or not provided for in groups F16D 121/04-F16D 121/10 [2012.01]
- 121/14 • Mechanical [2012.01]
- 121/16 • • for releasing a normally applied brake [2012.01]
- 121/18 • Electric or magnetic [2012.01]
- 121/20 • • using electromagnets [2012.01]
- 121/22 • • • for releasing a normally applied brake [2012.01]
- 121/24 • • using motors [2012.01]
- 121/26 • • • for releasing a normally applied brake [2012.01]
- 121/28 • • using electrostrictive or magnetostrictive elements, e.g. piezoelectric elements [2012.01]
- 121/30 • • • for releasing a normally applied brake [2012.01]
- 121/32 • using shape memory elements [2012.01]
- 121/34 • • for releasing a normally applied brake [2012.01]

**123/00 Multiple operation forces [2012.01]**

**Note(s) [2012.01]**

When indexing in this group, each kind of operation force must be indexed in the appropriate subgroups of group F16D 121/00.

**125/00 Components of actuators [2012.01]**

- 125/02 • Fluid-pressure mechanisms [2012.01]
- 125/04 • • Cylinders [2012.01]
- 125/06 • • Pistons [2012.01]
- 125/08 • • Seals, e.g. piston seals [2012.01]
- 125/10 • • Plural pistons interacting by fluid pressure, e.g. hydraulic force amplifiers using different sized pistons [2012.01]
- 125/12 • • Membrane or diaphragm types [2012.01]
- 125/14 • • Fluid-filled flexible members, e.g. enclosed air bladders [2012.01]
- 125/16 • • Devices for bleeding or filling [2012.01]
- 125/18 • Mechanical mechanisms [2012.01]
- 125/20 • • converting rotation to linear movement or vice-versa [2012.01]
- 125/22 • • • acting transversely to the axis of rotation [2012.01]
- 125/24 • • • • Rack-and-pinion [2012.01]
- 125/26 • • • • Cranks [2012.01]
- 125/28 • • • • Cams; Levers with cams [2012.01]
- 125/30 • • • • acting on two or more cam followers, e.g. S-cams [2012.01]
- 125/32 • • • • acting on one cam follower [2012.01]

## F16D

- 125/34 • • • acting in the direction of the axis of rotation [2012.01]
- 125/36 • • • • Helical cams; Ball-rotating ramps [2012.01]
- 125/38 • • • • • with plural cam or ball-ramp mechanisms arranged concentrically with the brake rotor axis [2012.01]
- 125/40 • • • • Screw-and-nut [2012.01]
- 125/42 • • • • Rack-and-worm gears [2012.01]
- 125/44 • • transmitting rotation [2012.01]
- 125/46 • • • Rotating members in mutual engagement [2012.01]
- 125/48 • • • • with parallel stationary axes, e.g. spur gears [2012.01]
- 125/50 • • • • with parallel non-stationary axes, e.g. planetary gearing [2012.01]
- 125/52 • • • • with non-parallel stationary axes, e.g. worm or bevel gears [2012.01]
- 125/54 • • • • with non-parallel non-stationary axes [2012.01]
- 125/56 • • • Shafts for transmitting torque directly [2012.01]
- 125/58 • • transmitting linear movement [2012.01]
- 125/60 • • • Cables or chains, e.g. Bowden cables [2012.01]
- 125/62 • • • • Fixing arrangements therefor, e.g. cable end attachments [2012.01]
- 125/64 • • • Levers [2012.01]
- 125/66 • • • Wedges [2012.01]
- 125/68 • • • Lever-link mechanisms, e.g. toggles with change of force ratio [2012.01]
- 125/70 • • • Rods [2012.01]
- 127/00 **Auxiliary mechanisms [2012.01]**
- 127/02 • Release mechanisms [2012.01]
- 127/04 • • for manual operation [2012.01]
- 127/06 • Locking mechanisms, e.g. acting on actuators, on release mechanisms or on force transmission mechanisms [2012.01]
- 127/08 • Self-amplifying or de-amplifying mechanisms [2012.01]
- 127/10 • • having wedging elements [2012.01]
- 127/12 • • having additional frictional elements [2012.01]
- 129/00 **Type of operation source for auxiliary mechanisms [2012.01]**
- 129/02 • Fluid-pressure [2012.01]
- 129/04 • Mechanical [2012.01]
- 129/06 • Electric or magnetic [2012.01]
- 129/08 • • Electromagnets [2012.01]
- 129/10 • • Motors [2012.01]
- 129/12 • • Electrostrictive or magnetostrictive elements, e.g. piezoelectric [2012.01]
- 129/14 • Shape memory elements [2012.01]
- 131/00 **Overall arrangement of the actuators or their elements, e.g. modular construction [2012.01]**
- 131/02 • of the actuator controllers [2012.01]

## F16F SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION

### Note(s)

1. This subclass **covers**:
  - springs, shock-absorbers or vibration-dampers;
  - their arrangement in, or adaptation for, particular apparatus, if not provided for in the subclasses covering said apparatus.
2. This subclass **does not cover** the arrangement or adaptation of springs, shock-absorbers or vibration-dampers in, or for, particular apparatus, if provided for in the subclasses concerning the said apparatus, e.g.
  - A47C 23/00-A47C 27/00.....Spring mattresses
  - A63C 5/075.....Vibration dampers in skis
  - B60G.....Vehicle suspensions
  - B60R 19/24.....Mounting of bumpers on vehicles
  - B61F.....Rail vehicle suspensions
  - B61G 11/00.....Buffers for railway or tramway vehicles
  - B62D 21/15.....Vehicle chassis frames having impact absorbing means
  - B62J 1/02.....Resiliently mounted saddles on cycles
  - B62K 21/08.....Steering dampers
  - B63H 1/15.....Marine propellers having vibration-damping means
  - B63H 21/30.....Anti-vibration mounting of marine propulsion plant in ships
  - B64C 25/58.....Arrangement of shock-absorbers or springs in aeroplane alighting gear
  - B65D 81/02.....Containers, packing elements or packages with shock-absorbing means
  - D06F 37/20.....Resilient mountings in washing machines
  - D06F 49/06.....Resilient mountings in domestic spin-dryers
  - F03G 1/00.....Spring motors
  - F21V 15/04.....Resilient mounting of lighting devices
  - F41A 25/00.....Gun cradles to permit recoil
  - F41B 5/20.....Vibration dampers for archery bows
  - G01D 11/00.....Indicating or recording in connection with measuring
  - G01G 21/10.....Weighing apparatus, e.g. arrangement of shock-absorbers in weighing apparatus
  - G04B.....Clocks, watches
  - G12B 3/08.....Damping of movements in instruments
  - G21C 7/20.....Disposition of shock-absorbing devices for displacable control elements in nuclear reactors.

### Subclass index

#### SPRINGS

Friction type; fluid type; magnetic type.....1/00, 3/00, 5/00, 9/00, 6/00

## VIBRATION-DAMPERS OR SHOCK-ABSORBERS

Friction type; fluid type.....	7/00, 11/00, 9/00, 11/00
UNITS COMBINING SPRINGS AND VIBRATION-DAMPERS OR SHOCK-ABSORBERS.....	13/00
SUPPRESSION OF VIBRATION, BALANCING.....	15/00

<b>1/00</b>	<b>Springs</b> (working with fluid F16F 5/00, F16F 9/00)	1/41	• • • the spring consisting of generally conically arranged elements [6]
1/02	• made of steel or other material having low internal friction (F16F 1/36 takes precedence); Wound, torsion, leaf, cup, ring or the like springs, the material of the spring not being relevant [6]	1/42	• • characterised by the mode of stressing
1/04	• • Wound springs	1/44	• • • loaded mainly in compression
1/06	• • • with turns lying in cylindrical surfaces	1/46	• • • loaded mainly in tension
1/08	• • • with turns lying in mainly conical surfaces	1/48	• • • loaded mainly in torsion
1/10	• • • Spiral springs with turns lying substantially in plane surfaces	1/50	• • • loaded mainly in shear
1/12	• • • Attachments or mountings	1/52	• • • loaded in combined stresses
1/13	• • • • comprising inserts or spacers between the windings for changing the mechanical or physical characteristics of the spring [6]	1/54	• • • • loaded in compression and shear
1/14	• • Torsion springs consisting of bars or tubes	<b>3/00</b>	<b>Spring units consisting of several springs, e.g. for obtaining a desired spring characteristic</b> (including fluid springs F16F 5/00, F16F 13/00)
1/16	• • • Attachments or mountings	3/02	• with springs made of steel or of other material having low internal friction
1/18	• • Leaf springs	3/04	• • composed only of wound springs
1/20	• • • with layers, e.g. anti-friction layers, or with rollers between the leaves	3/06	• • • of which some are placed around others in such a way that they damp each other by mutual friction
1/22	• • • with means for modifying the spring characteristic	3/07	• • combined with chambers filled with gas or liquid
1/24	• • • Lubrication; Covers, e.g. for retaining lubricant	3/08	• with springs made of a material having high internal friction, e.g. rubber
1/26	• • • Attachments or mountings (B60G 11/10 takes precedence) [5]	3/087	• Units comprising several springs made of plastics or the like material (F16F 1/40 takes precedence) [6]
1/28	• • • • comprising cylindrical metal pins pivoted in close-fitting sleeves	3/093	• • • the springs being of different materials, e.g. having different types of rubber [6]
1/30	• • • • comprising intermediate pieces made of rubber or similar elastic material	3/10	• • combined with springs made of steel or other material having low internal friction
1/32	• • Cup springs; Dished disc springs (diaphragms F16J 3/00)	3/12	• • • the steel spring being in contact with the rubber spring, e.g. being embedded in it [6]
1/34	• • Ring springs, i.e. annular bodies deformed radially due to axial load	<b>5/00</b>	<b>Liquid springs in which the liquid works as a spring by compression, e.g. combined with throttling action; Combinations of devices including liquid springs</b>
1/36	• made of plastics, e.g. rubber; made of material having high internal friction	<b>6/00</b>	<b>Magnetic springs; Fluid magnetic springs</b>
1/362	• • made of steel wool or compressed hair [6]	<b>7/00</b>	<b>Vibration-dampers; Shock-absorbers</b> (using fluid F16F 5/00, F16F 9/00; specific for rotary systems F16F 15/10)
1/364	• • made of cork, wood or the like material [6]	7/01	• using friction between loose particles, e.g. sand [6]
1/366	• • made of fibre reinforced plastics [6]	7/02	• with relatively-rotatable friction surfaces that are pressed together (F16F 7/01 takes precedence; one of the members being a spring F16F 13/02) [6]
1/368	• • • Leaf springs [6]	7/04	• • in the direction of the axis of rotation
1/37	• • of foam-like material, e.g. sponge rubber	7/06	• • in a direction perpendicular or inclined to the axis of rotation
1/371	• • characterised by inserts or auxiliary extension elements, e.g. for rigidification (F16F 1/366, F16F 1/387 take precedence) [6]	7/08	• with friction surfaces rectilinearly movable along each other (F16F 7/01 takes precedence) [6]
1/373	• • characterised by having a particular shape [6]	7/09	• • in dampers of the cylinder-and-piston type [6]
1/374	• • • having a spherical or the like shape [6]	7/10	• using inertia effect
1/376	• • • having projections, studs, serrations or the like on at least one surface (F16F 1/387 takes precedence) [6]	7/104	• • the inertia member being resiliently mounted [6]
1/377	• • • having holes or openings (F16F 1/387 takes precedence) [6]	7/108	• • • on plastics springs [6]
1/379	• • characterised by arrangements for regulating the spring temperature, e.g. by cooling [6]	7/112	• • • on fluid springs [6]
1/38	• • with a sleeve of elastic material between a rigid outer sleeve and a rigid inner sleeve or pin	7/116	• • • on metal springs [6]
1/387	• • • comprising means for modifying the rigidity in particular directions [6]	7/12	• using plastic deformation of members
1/393	• • • with spherical or conical sleeves [6]	7/14	• of cable-support type, i.e. frictionally-engaged loop-forming cables
1/40	• • consisting of a stack of similar elements separated by non-elastic intermediate layers		

- 9/00 Springs, vibration-dampers, shock-absorbers, or similarly-constructed movement-dampers using a fluid or the equivalent as damping medium**  
(F16F 5/00 takes precedence; connection of valves to inflatable elastic bodies B60C 29/00; door-operating appliances with fluid braking systems E05F)
- 9/02 • using gas only
- 9/04 • • in a chamber with a flexible wall
- 9/05 • • • the flexible wall being of the rolling diaphragm type [5]
- 9/06 • using both gas and liquid
- 9/08 • • in a chamber with a flexible wall
- 9/084 • • • comprising a gas spring contained within a flexible wall, the wall not being in contact with the damping fluid, i.e. mounted externally on the damper cylinder [6]
- 9/088 • • • comprising a gas spring with a flexible wall provided within the cylinder on the piston rod of a monotubular damper or within the inner tube of a bitubular damper [6]
- 9/092 • • • comprising a gas spring with a flexible wall provided between the tubes of a bitubular damper [6]
- 9/096 • • • comprising a hydropneumatic accumulator of the membrane type provided on the upper or the lower end of a damper or separately from or laterally on the damper [6]
- 9/10 • using liquid only; using a fluid of which the nature is immaterial
- 9/12 • • Devices with one or more rotary vanes turning in the fluid, any throttling effect being immaterial
- 9/14 • • Devices with one or more members, e.g. pistons, vanes, moving to and fro in chambers and using throttling effect
- 9/16 • • • involving only straight-line movement of the effective parts
- 9/18 • • • • with a closed cylinder and a piston separating two or more working spaces therein
- 9/19 • • • • • with a single cylinder
- 9/20 • • • • • with the piston-rod extending through both ends of the cylinder
- 9/22 • • • • • with one or more cylinders, each having a single working space closed by a piston or plunger
- 9/24 • • • • • with a single cylinder and a single piston or plunger
- 9/26 • • • • • with two cylinders in line and with the two pistons or plungers connected together
- 9/28 • • • • • with two parallel cylinders and with the two pistons or plungers connected together
- 9/30 • with solid or semi-solid material, e.g. pasty masses, as damping medium
- 9/32 • Details
- 9/34 • • Special valve constructions (valves in general F16K); Shape or construction of throttling passages
- 9/342 • • • Throttling passages operating with metering pins
- 9/344 • • • Vortex flow passages [6]
- 9/346 • • • Throttling passages in the form of slots arranged in cylinder walls
- 9/348 • • • Throttling passages in the form of annular discs operating in opposite directions
- 9/36 • • Special sealings, including sealings or guides for piston-rods
- 9/38 • • Covers for protection or appearance
- 9/40 • • Arrangements for preventing froth
- 9/42 • • Cooling arrangements
- 9/43 • • Filling arrangements, e.g. for supply of gas
- 9/44 • • Means on or in the damper for manual or non-automatic adjustment; such means combined with temperature correction (F16F 9/53, F16F 9/56 take precedence; temperature correction only F16F 9/52) [5, 6]
- 9/46 • • • allowing control from a distance
- 9/48 • • Arrangements for providing different damping effects at different parts of the stroke (F16F 9/53, F16F 9/56 take precedence) [5, 6]
- 9/49 • • • Stops limiting fluid passage, e.g. hydraulic stops
- 9/50 • • Special means providing automatic damping adjustment (F16F 9/53, F16F 9/56 take precedence) [5, 6]
- 9/504 • • • Inertia-sensitive means [6]
- 9/508 • • • Means responsive to the velocity of movement of the piston [6]
- 9/512 • • • Means responsive to load action on the damper or fluid pressure in the damper [6]
- 9/516 • • • resulting in the damping effects during contraction being different from the damping effects during extension [6]
- 9/52 • • • in case of change of temperature (combined with external adjustment F16F 9/44)
- 9/53 • • Means for adjusting damping characteristics by varying fluid viscosity, e.g. electromagnetically [5]
- 9/54 • • Arrangements for attachment
- 9/56 • • Means for adjusting the length of, or for locking, the spring or damper, e.g. at the end of the stroke [6]
- 9/58 • • Stroke limiting stops, e.g. arranged on the piston rod outside the cylinder (F16F 9/49 takes precedence) [6]
- 11/00 Vibration-dampers or shock-absorbers working with both friction and a damping fluid**
- 13/00 Units comprising springs of the non-fluid type as well as vibration-dampers, shock-absorbers, or fluid springs** (F16F 5/00 takes precedence)
- 13/02 • damping by frictional contact between the spring and braking means (frictionally coating wound springs F16F 3/06)
- 13/04 • comprising both a plastics spring and a damper, e.g. a friction damper [6]
- 13/06 • • the damper being a fluid damper, e.g. the plastics spring not forming a part of the wall of the fluid chamber of the damper (F16F 13/26 takes precedence) [6]
- 13/08 • • • the plastics spring forming at least a part of the wall of the fluid chamber of the damper (F16F 13/20-F16F 13/24 take precedence) [6]
- 13/10 • • • • the wall being at least in part formed by a flexible membrane or the like (F16F 13/12-F16F 13/18 take precedence) [6]
- 13/12 • • • • Single chamber dampers (F16F 13/14 takes precedence) [6]
- 13/14 • • • • Units of the bushing type [6]
- 13/16 • • • • specially adapted for receiving axial loads [6]

- 13/18 • • • characterised by the location or the shape of the equilibration chamber, e.g. the equilibration chamber surrounding the plastics spring or being annular (F16F 13/14 takes precedence) [6]
- 13/20 • • • characterised by comprising also a pneumatic spring (F16F 13/22 takes precedence) [6]
- 13/22 • • • characterised by comprising also a dynamic damper (dampers using inertia effect per se F16F 7/10) [6]
- 13/24 • • • the central part of the unit being supported by one element and both extremities of the unit being supported by a single other element, i.e. double acting mounting [6]
- 13/26 • • characterised by adjusting or regulating devices responsive to exterior conditions [6]
- 13/28 • • • specially adapted for units of the bushing type (F16F 13/30 takes precedence) [6]
- 13/30 • • • comprising means for varying fluid viscosity, e.g. of magnetic or electrorheological fluids [6]
- 15/00 Suppression of vibrations in systems** (vehicle seat suspension devices B60N 2/50); **Means or arrangements for avoiding or reducing out-of-balance forces, e.g. due to motion** (testing static or dynamic balance of machines or structures G01M 1/00)
- 15/02 • Suppression of vibrations of non-rotating, e.g. reciprocating, systems; Suppression of vibrations of rotating systems by use of members not moving with the rotating system (layered products B32B; suppression of vibration in ships B63)
- 15/023 • • using fluid means [6]
- 15/027 • • • comprising control arrangements [6]
- 15/03 • • using electromagnetic means (F16F 9/53 takes precedence) [5]
- 15/04 • • using elastic means (single elements or their attachment F16F 1/00-F16F 13/00) [2]
- 15/06 • • • with metal springs (with rubber springs also F16F 15/08)
- 15/067 • • • • using only wound springs [6]
- 15/073 • • • • using only leaf springs [6]
- 15/08 • • • with rubber springs
- 15/10 • Suppression of vibrations in rotating systems by making use of members moving with the system (by balancing F16F 15/22; with flywheels acting variably or intermittently F16H)
- 15/12 • • using elastic members or friction-damping members, e.g. between a rotating shaft and a gyratory mass mounted thereon (F16F 15/16 takes precedence) [6]
- 15/121 • • • using springs as elastic members, e.g. metallic springs (F16F 15/131 takes precedence) [6]
- 15/123 • • • • Wound springs [6]
- 15/124 • • • • Plastics springs, e.g. made of rubber (F16F 15/123 takes precedence) [6]
- 15/126 • • • • • consisting of at least one annular element surrounding the axis of rotation [6]
- 15/127 • • • • using plastics springs combined with other types of springs [6]
- 15/129 • • • characterised by friction-damping means (F16F 15/131 takes precedence) [6]
- 15/131 • • • the rotating system comprising two or more gyratory masses [6]
- 15/133 • • • • using springs as elastic members, e.g. metallic springs [6]
- 15/134 • • • • • Wound springs [6]
- 15/136 • • • • • Plastics springs, e.g. made of rubber (F16F 15/134 takes precedence) [6]
- 15/137 • • • • • the elastic members consisting of two or more springs of different types [6]
- 15/139 • • • • characterised by friction-damping means [6]
- 15/14 • • using freely-swinging masses rotating with the system
- 15/16 • • using a fluid (devices connecting input and output members F16D)
- 15/167 • • • having an inertia member, e.g. ring [6]
- 15/173 • • • • provided within a closed housing [6]
- 15/18 • • using electric means (dynamo-electric devices H02K)
- 15/20 • Suppression of vibrations of rotating systems by favourable grouping or relative arrangement of the moving members of the system or systems
- 15/22 • Compensation of inertia forces
- 15/24 • • of crankshaft systems by particular disposition of cranks, pistons, or the like
- 15/26 • • of crankshaft systems using solid masses, other than the ordinary pistons, moving with the system
- 15/28 • Counterweights; Attaching or mounting same (for roll-type closures E06B 9/62)
- 15/30 • Flywheels (F16F 15/16 takes precedence; suppression of vibrations in rotating systems using elastic members or friction-damping members moving with the system F16F 15/12; rotary-body aspects in general F16C 13/00, F16C 15/00) [6]
- 15/305 • • made of plastics, e.g. fibre reinforced plastics (FRP) [6]
- 15/31 • • characterised by means for varying the moment of inertia [6]
- 15/315 • • characterised by their supporting arrangement, e.g. mountings, cages, securing inertia member to shaft (F16F 15/31 takes precedence) [6]
- 15/32 • Correcting- or balancing-weights or equivalent means for balancing rotating bodies, e.g. vehicle wheels [2, 5]
- 15/34 • • Fastening arrangements therefor [5]
- 15/36 • • operating automatically [5]

## F16G BELTS, CABLES, OR ROPES, PREDOMINANTLY USED FOR DRIVING PURPOSES; CHAINS; FITTINGS PREDOMINANTLY USED THEREFOR

### Subclass index

BELTS; BELT FASTENINGS.....	1/00, 5/00, 3/00, 7/00
CABLES OR ROPES; FASTENINGS THEREFOR.....	9/00, 11/00
CHAINS, CHAIN HOOKS.....	13/00, 15/00, 17/00

- 1/00 Driving-belts** (V-belts F16G 5/00; conveyer belts B65G)
- 1/02 • made of leather (F16G 1/28 takes precedence; making thereof C14B 9/00)
  - 1/04 • made of fibrous material, e.g. textiles, whether rubber-covered or not (F16G 1/28 takes precedence; making thereof D03D)
  - 1/06 • made of rubber (F16G 1/28 takes precedence; producing belts from plastics or substances in a plastic state B29D 29/00)
    - 1/08 • • with reinforcement bonded by the rubber
    - 1/10 • • • with textile reinforcement
    - 1/12 • • • with metal reinforcement
  - 1/14 • made of plastics (F16G 1/28 takes precedence; producing belts from plastics or substances in a plastic state B29D 29/00)
    - 1/16 • • with reinforcement bonded by the plastic material
  - 1/18 • made of wire (making thereof B21F 43/00)
  - 1/20 • made of a single metal strip (making thereof B21D 53/14)
  - 1/21 • built-up from superimposed layers, e.g. zig-zag folded
  - 1/22 • consisting of several parts
  - 1/24 • • in the form of links (in the shape of chain links F16G 13/08)
  - 1/26 • • in the form of strips or lamellae
  - 1/28 • with a contact surface of special shape, e.g. toothed
- 3/00 Belt fastenings, e.g. for conveyer belts** (for V-belts F16G 7/00)
- 3/02 • with series of eyes or the like, interposed and linked by a pin to form a hinge (F16G 3/09 takes precedence)
  - 3/04 • • in which the ends of separate U-shaped or like eyes are attached to the belt by parts penetrating into it
  - 3/06 • with outwardly-bent, mutually-connected belt ends
  - 3/07 • Friction clamps, e.g. of grommet-thimble type
  - 3/08 • consisting of plates and screw-bolts or rivets (F16G 3/06 takes precedence)
    - 3/09 • • the plates forming a hinge
  - 3/10 • Joining belts by sewing, sticking, vulcanising, or the like; Constructional adaptations of the belt ends for this purpose
  - 3/12 • Joining belts by lacing
  - 3/14 • with extensible parts; with resilient parts
  - 3/16 • Devices or machines for connecting driving-belts or the like
- 5/00 V-belts, i.e. belts of tapered cross-section**
- 5/02 • made of leather (F16G 5/20 takes precedence)
  - 5/04 • made of rubber (F16G 5/20 takes precedence)
    - 5/06 • • with reinforcement bonded by the rubber
    - 5/08 • • • with textile reinforcement
    - 5/10 • • • with metal reinforcement
  - 5/12 • made of plastics (F16G 5/20 takes precedence)
    - 5/14 • • with reinforcement bonded by the plastic material
  - 5/16 • consisting of several parts
    - 5/18 • • in the form of links
  - 5/20 • with a contact surface of special shape, e.g. toothed
  - 5/22 • built-up from superimposed layers
  - 5/24 • • zig-zag folded
- 7/00 V-belt fastenings**
- 7/02 • locked, e.g. riveted
  - 7/04 • quickly detachable
- 7/06 • adjustable, e.g. for tension
- 9/00 Ropes or cables specially adapted for driving, or for being driven by, pulleys or other gearing elements**
- 9/02 • made of leather; having enveloping sheathings made of leather
  - 9/04 • made of rubber or plastics (F16G 9/02 takes precedence)
- 11/00 Means for fastening cables or ropes to one another or to other objects** (cable clamps for suspension bridge cables E01D 19/16); **Caps or sleeves for fixing on cables or ropes** (attaching ropes or cables to lift cars or cages B66B 7/08, to winch drums or barrels B66D 1/34; rope clamps in earth drilling E21B 19/12)
- 11/02 • with parts deformable to grip the cable or cables; Fastening means which engage a sleeve or the like fixed on the cable
  - 11/03 • incorporating resiliently-mounted members for attachment of the cable end
  - 11/04 • with wedging action, e.g. friction clamps of grommet-thimble type (F16G 11/02 takes precedence)
    - 11/05 • • by using conical plugs insertable between the strands
  - 11/06 • with laterally-arranged screws (F16G 11/02, F16G 11/04 take precedence)
  - 11/08 • Fastenings for securing ends of driving-cables to one another, the fastenings having approximately the same diameter as the cables
    - 11/09 • • incorporating hinge joints or pivots for the attachment of the cable ends
  - 11/10 • Quick-acting fastenings; Clamps holding in one direction only
  - 11/12 • Connections or attachments, e.g. turnbuckles, adapted for straining of cables, ropes or wire
  - 11/14 • Devices or coupling-pieces designed for easy formation of adjustable loops, e.g. choker hooks; Hooks or eyes with integral parts designed to facilitate quick attachment to cables or ropes at any point, e.g. by forming loops
- 13/00 Chains** (making thereof B21L)
- 13/02 • Driving-chains
    - 13/04 • • Toothed chains
    - 13/06 • • with links connected by parallel driving-pins with or without rollers
      - 13/07 • • • the links being of identical shape, e.g. cranked
    - 13/08 • • with links closely interposed on the joint pins (F16G 13/04 takes precedence)
      - 13/10 • • with universal joints
  - 13/12 • Hauling- or hoisting-chains
    - 13/14 • • built up from readily-separable links [3]
    - 13/16 • • with arrangements for holding electric cables, hoses, or the like
  - 13/18 • Chains having special overall characteristics
    - 13/20 • • stiff; Push-pull chains
    - 13/22 • • extensible
      - 13/24 • • • resilient
- 15/00 Chain couplings; Shackles; Chain joints; Chain links; Chain bushes** (making chain elements B21L)
- 15/02 • for fastening more or less permanently
  - 15/04 • Quickly-detachable chain couplings; Shackles
    - 15/06 • • Shackles designed for attachment by joint pins to chain elements, e.g. D-shackles
  - 15/08 • Swivels

- 15/10 • Emergency joints or links
- 15/12 • Chain links
- 15/14 • • made of sheet metal, e.g. profiled

**17/00 Hooks as integral parts of chains** (hooks for cranes B66C 1/34)

**F16H GEARING**

**Note(s)**

1. Combinations including mechanical gearings are classified in groups F16H 37/00 or F16H 47/00, unless they are provided for in groups F16H 1/00-F16H 35/00.
2. In this subclass, sets of rigidly-connected members are regarded as single members.
3. In this subclass, the following terms or expressions are used with the meanings indicated:
  - "toothed gearing" includes worm gearing and other gearing involving at least one wheel or sector provided with teeth or the equivalent, except gearing with chains or toothed belts, which is treated as friction gearing;
  - "conveying motion" includes transmitting energy, and means that the applied and resultant motions are of the same kind, though they may differ in, e.g. speed, direction or extent;
  - "rotary" implies that the motion may continue indefinitely.
  - "oscillating" means moving about an axis to an extent which is limited by the construction of the gearing and which may exceed one revolution, the movement being alternately forwards and backwards during continued operation of the gearing;
  - "reciprocating" means moving substantially in a straight line, the movement being alternately forwards and backwards during continued operation of the gearing;
  - "reversing" or "reversal" means that an applied movement in one direction may produce a resultant movement in either of two opposed directions at will;
  - "central gears" includes any gears whose axis is the main axis of the gearing.
4. Attention is drawn to the following places:
  - A01D 69/06.....Gearings in harvesters or mowers
  - A63H 31/00.....Gearing for toys
  - B21B 35/12.....Toothed-wheel gearing for metal-rolling mills
  - B60K.....Arrangement of transmissions in vehicles
  - B61C 9/00.....Transmissions for railway locomotives
  - B62D 3/00.....Vehicle steering gears
  - B62M.....Transmissions for cycles
  - B63H 23/00.....Transmissions for marine propulsion
  - B63H 25/00.....Marine steering gears
  - F01-F04.....Machines, engines, pumps
  - F15B 15/00.....Gearings associated with fluid-actuated devices
  - G01D 5/04.....Gearing used in indicating or recording apparatus in connection with measuring devices
  - H03J 1/00.....Driving arrangements for tuning resonant circuits
  - H04L 13/04.....Driving mechanisms for apparatus for transmission of coded digital information.

**Subclass index**

**GEARINGS NOT LIMITED TO ROTARY MOTION**

Mechanical gearings

- using levers, links, or cams.....21/00-25/00
- using intermittently-driving members.....27/00-31/00
- other gearings; combinations of gearings.....19/00, 33/00, 35/00, 37/00
- details.....51/00-57/00

Fluid gearing.....43/00

**GEARINGS FOR CONVEYING ROTARY MOTION**

- Toothed gearings.....1/00, 3/00
- Using endless flexible members.....7/00, 9/00
- Other friction gearing.....13/00, 15/00
- Fluid gearing.....39/00, 41/00, 45/00
- Using intermittently-driving gearing.....29/00

**CONTROL**

of change-speed- or reversing-gearings conveying rotary motion.....59/00-63/00

**COMBINATIONS OF GEARINGS; DIFFERENTIAL GEARINGS; OTHER GEARINGS.....47/00, 48/00, 49/00**

**GENERAL DETAILS OF GEARINGS.....57/00**

**Toothed gearings for conveying rotary motion**

**1/00 Toothed gearings for conveying rotary motion**  
(specific for conveying rotary motion with variable gear ratio or for reversing rotary motion F16H 3/00)

- 1/02 • without gears having orbital motion
- 1/04 • • involving only two intermeshing members
- 1/06 • • • with parallel axes

## F16H

- 1/08 • • • • the members having helical, herring-bone, or like teeth
- 1/10 • • • • one of the members being internally toothed
- 1/12 • • • with non-parallel axes
- 1/14 • • • • comprising conical gears only
- 1/16 • • • • comprising worm and worm-wheel
- 1/18 • • • • the members having helical, herring-bone, or like teeth (F16H 1/14 takes precedence)
- 1/20 • • involving more than two intermeshing members
- 1/22 • • • with a plurality of driving or driven shafts; with arrangements for dividing torque between two or more intermediate shafts
- 1/24 • • involving gears essentially having intermeshing elements other than involute or cycloidal teeth (F16H 1/16 takes precedence)
- 1/26 • • Special means compensating for misalignment of axes
- 1/28 • with gears having orbital motion
- 1/30 • • in which an orbital gear has an axis crossing the main axis of the gearing and has helical teeth or is a worm
- 1/32 • • in which the central axis of the gearing lies inside the periphery of an orbital gear
- 1/34 • • involving gears essentially having intermeshing elements other than involute or cycloidal teeth (in worm gearing F16H 1/30)
- 1/36 • • with two central gears coupled by intermeshing orbital gears
- 1/46 • • Systems consisting of a plurality of gear trains, each with orbital gears
- 1/48 • • Special means compensating for misalignment of axes

### 3/00 Toothed gearings for conveying rotary motion with variable gear ratio or for reversing rotary motion (speed-changing or reversing mechanisms F16H 59/00-F16H 63/00)

- 3/02 • without gears having orbital motion
- 3/04 • • with internally-toothed gears
- 3/06 • • with worm and worm-wheel or gears essentially having helical or herring-bone teeth
- 3/08 • • exclusively or essentially with continuously-meshing gears, that can be disengaged from their shafts

#### Note(s) [2006.01]

In this group, gears which can be put out of mesh are not taken into consideration if they are used for reversal only.

- 3/083 • • • with radially acting and axially controlled clutching members, e.g. sliding keys [5]
- 3/085 • • • with more than one output shaft [5]
- 3/087 • • • characterised by the disposition of the gears (F16H 3/083, F16H 3/085 take precedence) [5]

#### Note(s)

When counting the countershafts, the reverse countershaft is not taken into consideration if it is used for reversal only.

- 3/089 • • • • all of the meshing gears being supported by a pair of parallel shafts, one being the input shaft and the other the output shaft, there being no countershaft involved [5]
- 3/091 • • • • including a single countershaft [5]
- 3/093 • • • • with two or more countershafts [5]

- 3/095 • • • • with means for ensuring an even distribution of torque between the countershafts [5]
- 3/097 • • • • the input and output shafts being aligned on the same axis [5]
- 3/10 • • • with one or more one-way clutches as an essential feature
- 3/12 • • • with means for synchronisation not incorporated in the clutches (synchronised clutches F16D 23/02)
- 3/14 • • • Gearings for reversal only
- 3/16 • • essentially with both gears that can be put out of gear and continuously-meshing gears that can be disengaged from their shafts

#### Note(s) [2006.01]

In this group, gears which can be put out of mesh are not taken into consideration if they are used for reversal only.

- 3/18 • • • Gearings for reversal only
- 3/20 • • exclusively or essentially using gears that can be moved out of gear

#### Note(s) [2006.01]

In this group, gears which can be put out of mesh are not taken into consideration if they are used for reversal only.

- 3/22 • • • with gears shiftable only axially
- 3/24 • • • • with driving and driven shafts coaxial
- 3/26 • • • • and two or more additional shafts
- 3/28 • • • • • an additional shaft being coaxial with the main shafts
- 3/30 • • • • with driving and driven shafts not coaxial
- 3/32 • • • • • and an additional shaft
- 3/34 • • • with gears shiftable otherwise than only axially
- 3/36 • • • with a single gear meshable with any of a set of coaxial gears of different diameters
- 3/38 • • • with synchro-meshing
- 3/40 • • • Gearings for reversal only
- 3/42 • • with gears having teeth formed or arranged for obtaining multiple gear ratios, e.g. nearly infinitely variable
- 3/44 • using gears having orbital motion
- 3/46 • • Gearings having only two central gears, connected by orbital gears (F16H 3/68-F16H 3/78 take precedence)
- 3/48 • • • with single orbital gears or pairs of rigidly-connected orbital gears
- 3/50 • • • • comprising orbital conical gears
- 3/52 • • • • comprising orbital spur gears
- 3/54 • • • • • one of the central gears being internally toothed and the other externally toothed
- 3/56 • • • • • both central gears being sun gears
- 3/58 • • • with sets of orbital gears, each consisting of two or more intermeshing orbital gears
- 3/60 • • • Gearings for reversal only
- 3/62 • • Gearings having three or more central gears (F16H 3/68-F16H 3/78 take precedence)
- 3/64 • • • composed of a number of gear trains, the drive always passing through all the trains, each train having not more than one connection for driving another train
- 3/66 • • • composed of a number of gear trains without drive passing from one train to another
- 3/68 • • in which an orbital gear has an axis crossing the main axis of the gearing and has helical teeth or is a worm

- 3/70 • • in which the central axis of the gearing lies inside the periphery of an orbital gear
- 3/72 • • with a secondary drive, e.g. regulating motor, in order to vary speed continuously
- 3/74 • • Complexes, not using actuatable speed-changing or regulating members, e.g. with gear ratio determined by free play of frictional or other forces
- 3/76 • • with an orbital gear having teeth formed or arranged for obtaining multiple gear ratios, e.g. nearly infinitely variable
- 3/78 • • Special adaptation of synchronisation mechanisms to these gearings

#### **Gearing for conveying rotary motion by endless flexible members**

- 7/00 Gearings for conveying rotary motion by endless flexible members** (specific for conveying rotary motion with variable gear ratio or for reversing rotary motion F16H 9/00; endless flexible members per se, e.g. belts or chains F16G)
  - 7/02 • with belts; with V-belts
  - 7/04 • with ropes
  - 7/06 • with chains
  - 7/08 • Means for varying tension of belts, ropes, or chains (pulleys of adjustable construction F16H 55/52)
  - 7/10 • • by adjusting the axis of a pulley
  - 7/12 • • • of an idle pulley
  - 7/14 • • • of a driving or driven pulley
  - 7/16 • • • • without adjusting the driving or driven shaft
  - 7/18 • Means for guiding or supporting belts, ropes, or chains (construction of pulleys F16H 55/36)
  - 7/20 • • Mountings for rollers or pulleys
  - 7/22 • Belt, rope, or chain shifters
  - 7/24 • Equipment for mounting belts, ropes, or chains
- 9/00 Gearings for conveying rotary motion with variable gear ratio, or for reversing rotary motion, by endless flexible members** (control of change-speed or reversing-gearings conveying rotary motion F16H 59/00-F16H 63/00; endless flexible members per se, e.g. belts or chains F16G)
  - 9/02 • without members having orbital motion
  - 9/04 • • using belts, V-belts, or ropes (with toothed belts F16H 9/24; pulleys of adjustable construction F16H 55/52)
    - 9/06 • • • engaging a stepped pulley
    - 9/08 • • • engaging a conical drum (F16H 9/12 takes precedence)
    - 9/10 • • • engaging a pulley provided with radially-actuatable elements carrying the belt
    - 9/12 • • • engaging a pulley built-up out of relatively axially-adjustable parts in which the belt engages the opposite flanges of the pulley directly without interposed belt-supporting members
    - 9/14 • • • • using only one pulley built-up out of adjustable conical parts
    - 9/16 • • • • using two pulleys, both built-up out of adjustable conical parts
    - 9/18 • • • • • only one flange of each pulley being adjustable
    - 9/20 • • • • • both flanges of the pulleys being adjustable
    - 9/22 • • • specially adapted for ropes

- 9/24 • • using chains, toothed belts, belts in the form of links; Chains or belts specially adapted to such gearing (toothed belts F16G 1/28; V-belts in the form of links F16G 5/18; toothed V-belts F16G 5/20)
- 9/26 • with members having orbital motion

#### **Other friction gearing for conveying rotary motion**

- 13/00 Gearing for conveying rotary motion with constant gear ratio by friction between rotary members** (specific for conveying rotary motion with variable gear ratio or for reversing rotary motion F16H 15/00)
  - 13/02 • without members having orbital motion
  - 13/04 • • with balls or with rollers acting in a similar manner
  - 13/06 • with members having orbital motion
  - 13/08 • • with balls or with rollers acting in a similar manner
  - 13/10 • Means for influencing the pressure between the members
    - 13/12 • • by magnetic forces
    - 13/14 • • for automatically varying the pressure mechanically
- 15/00 Gearings for conveying rotary motion with variable gear ratio, or for reversing rotary motion, by friction between rotary members** (control of change-speed or reversing-gearings conveying rotary motion F16H 59/00-F16H 63/00)
  - 15/01 • characterised by the use of a magnetisable powder or liquid as friction medium between the rotary members [2]
  - 15/02 • without members having orbital motion
  - 15/04 • • Gearings providing a continuous range of gear ratios
    - 15/06 • • • in which a member A of uniform effective diameter mounted on a shaft may co-operate with different parts of a member B
    - 15/08 • • • • in which the member B is a disc with a flat or approximately-flat friction surface
    - 15/10 • • • • • in which the axes of the two members cross or intersect
    - 15/12 • • • • • • in which one or each member is duplicated, e.g. for obtaining better transmission, for lessening the reaction forces on the bearings
    - 15/14 • • • • • in which the axes of the members are parallel or approximately parallel
    - 15/16 • • • • • in which the member B has a conical friction surface
      - 15/18 • • • • • externally
      - 15/20 • • • • • • co-operating with the outer rim of the member A, which is perpendicular or nearly perpendicular to the friction surface of the member B
      - 15/22 • • • • • • the axes of the members being parallel or approximately parallel
        - 15/24 • • • • • internally
        - 15/26 • • • • • in which the member B has a spherical friction surface centered on its axis of revolution
          - 15/28 • • • • • with external friction surface
          - 15/30 • • • • • with internal friction surface

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- 15/32 • • • • in which the member B has a curved friction surface formed as a surface of a body of revolution generated by a curve which is neither a circular arc centered on its axis of revolution nor a straight line
- 15/34 • • • • with convex friction surface
- 15/36 • • • • with concave friction surface, e.g. a hollow toroid surface
- 15/38 • • • • with two members B having hollow toroid surfaces opposite to each other, the member or members A being adjustably mounted between the surfaces
- 15/40 • • • in which two members co-operate by means of balls, or rollers of uniform effective diameter, not mounted on shafts
- 15/42 • • • in which two members co-operate by means of rings or by means of parts of endless flexible members pressed between the first-mentioned members
- 15/44 • • • in which two members of non-uniform effective diameter directly co-operate with one another
- 15/46 • • Gearings providing a discontinuous or stepped range of gear ratios
- 15/48 • with members having orbital motion
- 15/50 • • Gearings providing a continuous range of gear ratios
- 15/52 • • • in which a member of uniform effective diameter mounted on a shaft may co-operate with different parts of another member
- 15/54 • • • in which two members co-operate by means of rings or by means of parts of endless flexible members pressed between the first-mentioned members
- 15/56 • • Gearings providing a discontinuous or stepped range of gear ratios

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### 19/00 Gearings comprising essentially only toothed gears or friction members and not capable of conveying indefinitely-continuing rotary motion (with intermittently-driving members F16H 27/00-F16H 31/00; rope or like tackle for lifting or haulage B66D 3/00)

- 19/02 • for interconverting rotary motion and reciprocating motion
- 19/04 • • comprising a rack
- 19/06 • • comprising an endless flexible member
- 19/08 • for interconverting rotary motion and oscillating motion

### Gearing for conveying or converting motion by means of levers, links, cams or screw-and-nut mechanisms

- 21/00 **Gearings comprising primarily only links or levers, with or without slides** (F16H 23/00 takes precedence)
- 21/02 • the movements of two or more independently-moving members being combined into a single movement
- 21/04 • Guiding mechanisms, e.g. for straight-line guidance (for drawing-machines B43L)
- 21/06 • which can be made ineffective when desired
- 21/08 • • by pushing a reciprocating rod out of its operative position
- 21/10 • all movement being in, or parallel to, a single plane

- 21/12 • • for conveying rotary motion
- 21/14 • • • by means of cranks, eccentrics, or like members fixed to one rotary member and guided along tracks on the other
- 21/16 • • for interconverting rotary motion and reciprocating motion
- 21/18 • • • Crank gearings; Eccentric gearings
- 21/20 • • • • with adjustment of throw (adjustable cranks or eccentrics F16C 3/28; adjustable connecting-rods F16C 7/06)
- 21/22 • • • • with one connecting-rod and one guided slide to each crank or eccentric
- 21/24 • • • • without further links or guides
- 21/26 • • • • with toggle action
- 21/28 • • • • with cams or additional guides
- 21/30 • • • • with members having rolling contact
- 21/32 • • • • with additional members comprising only pivoted links or arms
- 21/34 • • • • with two or more connecting-rods to each crank or eccentric
- 21/36 • • • • without swinging connecting-rod, e.g. with epicyclic parallel motion, slot-and- crank motion
- 21/38 • • • • with means for temporary energy accumulation, e.g. to overcome dead-centre positions
- 21/40 • • for interconverting rotary motion and oscillating motion
- 21/42 • • • with adjustable throw
- 21/44 • • for conveying or interconverting oscillating or reciprocating motions
- 21/46 • with movements in three dimensions
- 21/48 • • for conveying rotary motion
- 21/50 • • for interconverting rotary motion and reciprocating motion
- 21/52 • • for interconverting rotary motion and oscillating motion
- 21/54 • • for conveying or interconverting oscillating or reciprocating motions

### 23/00 Wobble-plate gearings; Oblique-crank gearings

- 23/02 • with adjustment of throw by changing the position of the wobble-member (F16H 29/04, F16H 33/10 take precedence)
- 23/04 • with non-rotary wobble-members
- 23/06 • • with sliding members hinged to reciprocating members
- 23/08 • • connected to reciprocating members by connecting-rods
- 23/10 • with rotary wobble-plates with plane surfaces

### 25/00 Gearings comprising primarily only cams, cam-followers and screw-and-nut mechanisms

- 25/02 • the movements of two or more independently-moving members being combined into a single movement
- 25/04 • for conveying rotary motion
- 25/06 • • with intermediate members guided along tracks on both rotary members
- 25/08 • for interconverting rotary motion and reciprocating motion (F16H 23/00 takes precedence)
- 25/10 • • with adjustable throw (adjustable cams F16H 53/04)
- 25/12 • • with reciprocation along the axis of rotation, e.g. gearings with helical grooves and automatic reversal (screw mechanisms without automatic reversal F16H 25/20)

- 25/14 • • with reciprocation perpendicular to the axis of rotation (F16H 21/36 takes precedence)
- 25/16 • for interconverting rotary motion and oscillating motion
- 25/18 • for conveying or interconverting oscillating or reciprocating motions
- 25/20 • • Screw mechanisms (with automatic reversal F16H 25/12)
- 25/22 • • • with balls, rollers, or similar members between the co-operating parts; Elements essential to the use of such members
- 25/24 • • • Elements essential to such mechanisms, e.g. screws, nuts (F16H 25/22 takes precedence)

### **Gearings with intermittently-driving members**

- 27/00 Step-by-step mechanisms without freewheel members, e.g. Geneva drives** (rotary gearings with cyclically-varying velocity ratio F16H 35/02; impulse couplings F16D 5/00; clockwork escapements G04B 15/00)
  - 27/02 • with at least one reciprocating or oscillating transmission member
  - 27/04 • for converting continuous rotation into a step-by-step rotary movement
  - 27/06 • • Mechanisms with driving pins in driven slots, e.g. Geneva drives
  - 27/08 • • with driving toothed gears with interrupted toothing
  - 27/10 • • obtained by means of disengageable transmission members, combined or not combined with mechanisms according to group F16H 27/06 or F16H 27/08
- 29/00 Gearings for conveying rotary motion with intermittently-driving members, e.g. with freewheel action** (freewheels F16D 41/00)
  - 29/02 • between one of the shafts and an oscillating or reciprocating intermediate member, not rotating with either of the shafts (F16H 29/20, F16H 29/22 take precedence)
  - 29/04 • • in which the transmission ratio is changed by adjustment of a crank, an eccentric, a wobble-plate, or a cam, on one of the shafts
  - 29/06 • • • with concentric shafts, an annular intermediate member moving around and being supported on an adjustable crank or eccentric
  - 29/08 • • in which the transmission ratio is changed by adjustment of the path of movement, the location of the pivot, or the effective length, of an oscillating connecting member
  - 29/10 • • in which the transmission ratio is changed by directly acting on the intermittently driving members
  - 29/12 • between rotary driving and driven members (F16H 29/20, F16H 29/22 take precedence)
  - 29/14 • • in which the transmission ratio is changed by adjustment of an otherwise stationary guide member for the intermittently-driving members
  - 29/16 • • in which the transmission ratio is changed by adjustment of the distance between the axes of the rotary members
  - 29/18 • • • in which the intermittently-driving members slide along approximately radial guides while rotating with one of the rotary members
  - 29/20 • the intermittently-acting members being shaped as worms, screws, or racks

- 29/22 • with automatic speed change

**31/00 Other gearings with freewheeling members or other intermittently-driving members** (F16H 21/00, F16H 23/00, F16H 25/00 take precedence; gearings involving the use of automatic changing-mechanisms, e.g. cyclically-actuated reversal gearings, see the appropriate groups)

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### **33/00 Gearings based on repeated accumulation and delivery of energy**

- 33/02 • Rotary transmissions with mechanical accumulators, e.g. weights, springs, intermittently-connected flywheels
- 33/04 • • Gearings for conveying rotary motion with variable velocity ratio, in which self-regulation is sought
- 33/06 • • • based essentially on spring action (ratchet slip couplings F16D 7/04)
- 33/08 • • • based essentially on inertia
- 33/10 • • • • with gyroscopic action, e.g. comprising wobble-plates, oblique cranks
- 33/12 • • • • with a driving member connected differentially with both a driven member and an oscillatory member with large resistance to movement, e.g. Constantinesco gearing
- 33/14 • • • • having orbital members influenced by regulating masses
- 33/16 • • • • • which have their own free motion, or consist of fluid
- 33/18 • • • • • of which the motion is constrained
- 33/20 • for interconversion, based essentially on inertia, of rotary motion and reciprocating or oscillating motion

### **35/00 Gearings or mechanisms with other special functional features**

- 35/02 • for conveying rotary motion with cyclically-varying velocity ratio (speed-changing mechanisms operating cyclically, see the appropriate groups)
- 35/06 • Gearings designed to allow relative movement between supports thereof without ill effects (F16H 1/26, F16H 1/48 take precedence)
- 35/08 • for adjustment of members on moving parts from a stationary place
- 35/10 • Arrangements or devices for absorbing overload or preventing damage by overload (couplings for transmitting rotation F16D)
- 35/12 • Transmitting mechanisms with delayed effect (vibration- or shock-dampers in general F16F)
- 35/14 • Mechanisms with only two stable positions, e.g. acting at definite angular positions
- 35/16 • Mechanisms for movements or movement relations conforming to mathematical formulae (devices in which computing operations are performed mechanically G06G 3/00)
- 35/18 • Turning devices for rotatable members, e.g. shafts (starting devices for internal-combustion engines F02N)
- 37/00 Combinations of mechanical gearings, not provided for in groups F16H 1/00-F16H 35/00** (combinations of mechanical gearing with fluid clutches or fluid gearing F16H 47/00; applications of underdrives or overdrives in motor vehicles, combinations with differential gearings in motor vehicles B60K)
  - 37/02 • comprising essentially only toothed or friction gearings

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- 37/04 • • Combinations of toothed gearings only (F16H 37/06 takes precedence)
- 37/06 • • with a plurality of driving or driven shafts; with arrangements for dividing torque between two or more intermediate shafts
- 37/08 • • • with differential gearing
- 37/10 • • • • at both ends of intermediate shafts
- 37/12 • Gearings comprising primarily toothed or friction gearing, links or levers, and cams, or members of at least two of these three types (F16H 21/14, F16H 21/28, F16H 21/30 take precedence; toothed or friction gearing or cam gearing, with only an additional lever or link, *see* the appropriate group for the main gearing)
- 37/14 • • the movements of two or more independently-moving members being combined into a single movement
- 37/16 • • with a driving or driven member which both rotates or oscillates on its axis and reciprocates

### Fluid gearing [3]

- 39/00 **Rotary fluid gearing using pumps and motors of the volumetric type, i.e. passing a predetermined volume of fluid per revolution** (control of exclusively fluid gearing F16H 61/38; fluid couplings or clutches with pumping sets of volumetric type F16D 31/00; application to lifting or pushing equipment B66F) [5]
- 39/01 • Pneumatic gearing; Gearing working with subatmospheric pressure (pneumatic hammers B25D 9/00) [2]
- 39/02 • with liquid motors at a distance from liquid pumps
- 39/04 • with liquid motor and pump combined in one unit
- 39/06 • • pump and motor being of the same type
- 39/08 • • • each with one main shaft and provided with pistons reciprocating in cylinders
- 39/10 • • • • with cylinders arranged around, and parallel or approximately parallel to, the main axis of the gearing
- 39/12 • • • • • with stationary cylinders
- 39/14 • • • • • with cylinders carried in rotary cylinder blocks or cylinder-bearing members
- 39/16 • • • • • with cylinders arranged perpendicular to the main axis of the gearing
- 39/18 • • • • • the connections of the pistons being at the outer ends of the cylinders
- 39/20 • • • • • the connections of the pistons being at the inner ends of the cylinders
- 39/22 • • • with liquid chambers shaped as bodies of revolution concentric with the main axis of the gearing
- 39/24 • • • • with rotary displacement members, e.g. provided with axially or radially movable vanes passing movable sealing members
- 39/26 • • • with liquid chambers not shaped as bodies of revolution or shaped as bodies of revolution eccentric to the main axis of the gearing
- 39/28 • • • • with liquid chambers formed in rotary members
- 39/30 • • • • with liquid chambers formed in stationary members
- 39/32 • • • • • with sliding vanes carried by the rotor
- 39/34 • • • in which a rotor on one shaft co-operates with a rotor on another shaft
- 39/36 • • • • toothed-gear type
- 39/38 • • • • Displacement screw-pump type

- 39/40 • • • Hydraulic differential gearings, e.g. having a rotary input housing with interconnected liquid chambers for both outputs
- 39/42 • • pump and motor being of different types

### 41/00 Rotary fluid gearing of the hydrokinetic type

(control of exclusively fluid gearing F16H 61/38; rotary fluid couplings or clutches of the hydrokinetic type F16D 33/00) [5]

- 41/02 • with pump and turbine connected by conduits or ducts
- 41/04 • Combined pump-turbine units
- 41/22 • • Gearing systems consisting of a plurality of hydrokinetic units operating alternatively, e.g. made effective or ineffective by filling or emptying or by mechanical clutches
- 41/24 • Details
- 41/26 • • Shape of runner blades or channels with respect to function
- 41/28 • • with respect to manufacture, e.g. blade attachment
- 41/30 • • relating to venting, lubrication, cooling, circulation of the cooling medium
- 41/32 • Selection of working fluids (chemical aspects, *see* the relevant classes)

### 43/00 Other fluid gearing, e.g. with oscillating input or output [2]

- 43/02 • Fluid gearing actuated by pressure waves [2]

### 45/00 Combinations of fluid gearings for conveying rotary motion with couplings or clutches

(F16H 41/22 takes precedence; conjoint control of driveline clutches and change-speed gearing in vehicles B60W 10/02, B60W 10/10) [2]

#### Note(s)

Clutches for varying working conditions in fluid torque-converters are regarded as a part of the latter.

- 45/02 • with mechanical clutches for bridging a fluid gearing of the hydrokinetic type (control of torque converter lock-up clutches F16H 61/14)

### 47/00 Combinations of mechanical gearing with fluid clutches or fluid gearing

(conjoint control of driveline clutches and change-speed gearing in vehicles B60W 10/02, B60W 10/10) [2]

- 47/02 • the fluid gearing being of the volumetric type
- 47/04 • • the mechanical gearing being of the type with members having orbital motion
- 47/06 • the fluid gearing being of the hydrokinetic type
- 47/07 • • using two or more power-transmitting fluid circuits (F16H 47/10 takes precedence) [2]
- 47/08 • • the mechanical gearing being of the type with members having orbital motion
- 47/10 • • • using two or more power-transmitting fluid circuits [2]
- 47/12 • • • the members with orbital motion having vanes interacting with the fluid [2]

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### 48/00 Differential gearings

(cooling or lubricating of differential gearing F16H 57/04) [6, 2012.01]

#### Note(s) [2012.01]

When classifying in this group, in the absence of an indication to the contrary, classification is made in all appropriate places.

- 48/05 • Multiple interconnected differential sets [2012.01]

- 48/06 • with gears having orbital motion [6]
  - 48/08 • • with orbital conical gears [6]
  - 48/10 • • with orbital spur gears [6, 2012.01]
  - 48/11 • • • having intermeshing planet gears [2012.01]
  - 48/12 • without gears having orbital motion [6, 2012.01]
  - 48/14 • • with cams [6]
  - 48/16 • • • with freewheels [6]
  - 48/18 • • • with fluid gearing [6]
  - 48/19 • • • consisting of two linked clutches [2012.01]
  - 48/20 • Arrangements for suppressing or influencing the differential action, e.g. locking devices [6, 2012.01]
  - 48/22 • • using friction clutches or brakes [6]
  - 48/24 • • using positive clutches or brakes [6]
  - 48/26 • • using fluid action, e.g. viscous clutches [6]
  - 48/27 • • using internally-actuatable fluid pressure, e.g. internal pump types [2012.01]
  - 48/28 • • using self-locking gears or self-braking gears [6, 2012.01]
  - 48/285 • • • with self-braking intermeshing gears having parallel axes and having worms or helical teeth [2012.01]
  - 48/29 • • • with self-braking intermeshing gears having perpendicular arranged axes and having worms or helical teeth [2012.01]
  - 48/295 • • using multiple means for force boosting [2012.01]
  - 48/30 • • using externally-actuatable means [6, 2012.01]
  - 48/32 • • • using fluid pressure actuators [2012.01]
  - 48/34 • • • using electromagnetic or electric actuators [2012.01]
  - 48/36 • characterised by intentionally generating speed difference between outputs [2012.01]
  - 48/38 • Constructional details (the outer casing comprising the differential and supporting input and output shafts F16H 57/037) [2012.01]
  - 48/40 • • characterised by features of the rotating cases [2012.01]
  - 48/42 • • characterised by features of the input shafts, e.g. mounting of drive gears thereon [2012.01]
  - 49/00 **Other gearing**
- Details of gearing or mechanisms**
- 51/00 **Levers of gearing mechanisms** (shafts, Bowden mechanisms, cranks, eccentrics, bearings, pivotal connections, crossheads, connecting-rods F16C; manipulating levers G05G)
  - 51/02 • adjustable
  - 53/00 **Cams or cam-followers, e.g. rollers for gearing mechanisms** (shafts, Bowden mechanisms, cranks, eccentrics, bearings, pivotal connections, crossheads, connecting-rods F16C; cams specially adapted for reciprocating-piston liquid engines F03C 1/30)
  - 53/02 • Single-track cams for single-revolution cycles; Camshafts with such cams
  - 53/04 • • Adjustable cams
  - 53/06 • Cam-followers (F16H 53/08 takes precedence)
  - 53/08 • Multi-track cams, e.g. for cycles consisting of several revolutions; Cam-followers specially adapted for such cams
  - 55/00 **Elements with teeth or friction surfaces for conveying motion; Worms, pulleys or sheaves for gearing mechanisms** (of screw-and-nut gearing F16H 25/00; shafts, Bowden mechanisms, cranks, eccentrics, bearings, pivotal connections, crossheads, connecting-rods F16C; chains, belts F16G; pulley-blocks for lifting or hauling appliances B66D 3/04) [4]
  - 55/02 • Toothed members; Worms
  - 55/06 • • Use of materials; Use of treatments of toothed members or worms to affect their intrinsic material properties [3]
  - 55/08 • • Profiling [3]
  - 55/10 • • Constructively simple tooth shapes, e.g. shaped as pins, as balls [3]
  - 55/12 • • with body or rim assembled out of detachable parts [3]
  - 55/14 • • Construction providing resilience or vibration-damping (F16H 55/06 takes precedence; resilient coupling of wheel or wheel-rim with shaft F16D 3/50, F16D 3/80) [3]
  - 55/16 • • • relating to teeth only [3]
  - 55/17 • • Toothed wheels (worm wheels F16H 55/22; chain wheels F16H 55/30) [3]
  - 55/18 • • • Special devices for taking-up backlash
  - 55/20 • • • • for bevel gears
  - 55/22 • • for transmissions with crossing shafts, especially worms, worm-gears (bevel gears, crown wheels, helical gears F16H 55/17)
  - 55/24 • • • Special devices for taking up backlash
  - 55/26 • • Racks
  - 55/28 • • • Special devices for taking up backlash
  - 55/30 • • Chain wheels (specially adapted for cycles B62M)
  - 55/32 • Friction members (friction surfaces F16D 69/00)
  - 55/34 • • Non-adjustable friction discs
  - 55/36 • • Pulleys (with features essential for adjustment F16H 55/52)
  - 55/38 • • • Means or measures for increasing adhesion (in general F16D 69/00)
  - 55/40 • • • with spokes (F16H 55/48 takes precedence)
  - 55/42 • • • Laminated pulleys
  - 55/44 • • • Sheet-metal pulleys
  - 55/46 • • • Split pulleys
  - 55/48 • • • manufactured exclusively or in part of non-metallic material, e.g. plastics (F16H 55/38, F16H 55/42, F16H 55/46 take precedence)
  - 55/49 • • • Features essential to V-belt pulleys [2]
  - 55/50 • • • Features essential to rope pulleys
  - 55/52 • • Pulleys or friction discs of adjustable construction
  - 55/54 • • • of which the bearing parts are radially adjustable
  - 55/56 • • • of which the bearing parts are relatively axially adjustable
  - 57/00 **General details of gearing** (of screw-and-nut gearing F16H 25/00; of fluid gearing F16H 39/00-F16H 43/00) [1, 2012.01]
  - 57/01 • Monitoring wear or stress of transmission elements, e.g. for triggering maintenance [2012.01]
  - 57/02 • Gearboxes; Mounting gearing therein [1, 2012.01]
- Note(s) [2012.01]**
- When classifying in this group, in the absence of an indication to the contrary, classification is made in all appropriate subgroups.
- 57/021 • • Shaft support structures, e.g. partition walls, bearing eyes, casing walls or covers with bearings [2012.01]

- 57/022 • • • *Adjustment of transmission shafts or bearings (for compensating misalignment of axes of toothed gearings without orbital motion F16H 1/26; for compensating misalignment of axes of planetary gears F16H 1/48) [2012.01]*
- 57/023 • • *Mounting or installation of gears or shafts in gearboxes, e.g. methods or means for assembly [2012.01]*
- 57/025 • • *Support of gearboxes, e.g. torque arms, or attachment to other devices (mounting of transmissions in vehicles B60K 17/00) [2012.01]*
- 57/027 • • *characterised by means for venting gearboxes, e.g. air breathers [2012.01]*
- 57/028 • • *characterised by means for reducing vibration or noise [2012.01]*
- 57/029 • • *characterised by means for sealing gearboxes, e.g. to improve airtightness [2012.01]*
- 57/03 • • *characterised by means for reinforcing gearboxes, e.g. ribs [2012.01]*
- 57/031 • • *characterised by covers or lids for gearboxes [2012.01]*
- 57/032 • • *characterised by the materials used [2012.01]*
- 57/033 • • *Series gearboxes, e.g. gearboxes based on the same design being available in different sizes or gearboxes using a combination of several standardised units [2012.01]*
- 57/035 • • *Gearboxes for transmissions with endless flexible members [2012.01]*
- 57/037 • • *Gearboxes for accommodating differential gearing (rotating cases for differential gearings F16H 48/40) [2012.01]*
- 57/038 • • *Gearboxes for accommodating bevel gears (F16H 57/037 takes precedence) [2012.01]*
- 57/039 • • *Gearboxes for accommodating worm gears [2012.01]*
- 57/04 • *Features relating to lubrication or cooling (control of lubrication or cooling in hydrostatic gearing F16H 61/4165) [1, 2010.01]*
- 57/05 • • *of chains (for conveyers B65G 45/08)*
- 57/08 • *of gearings with members having orbital motion*
- 57/10 • • *Braking arrangements*
- 57/12 • *Arrangements for adjusting or for taking-up backlash not provided for elsewhere [2]*

### Control of gearing conveying rotary motion [5]

#### Note(s)

1. Attention is drawn to the Notes following the title of subclass B60W.
2. In groups F16H 59/00-F16H 63/00, clutches positioned within a gearbox are considered as comprising part of the gearings.
3. In groups F16H 59/00-F16H 63/00, the following terms or expressions are used with the meaning indicated:
  - "final output element" means the final element which is moved to establish a gear ratio, i.e. which achieves the linking between two power transmission means, e.g. reverse idler gear, gear cluster, coupling sleeve, apply piston of a hydraulic clutch;

- "mechanism" means a kinematic chain consisting either of a single element or alternatively of a series of elements, the position of each point on the kinematic chain being derivable from the position of any other point on the chain, and therefore, for a given position of a point on one of the elements forming the kinematic chain there is only one position for each of the other points on the element or series of elements forming the kinematic chain;
  - "final output mechanism" means the mechanism which includes the final output element;
  - "actuating mechanism" means the mechanism, the movement of which causes the movement of another mechanism by being in mutual contact;
  - "final actuating mechanism" means the mechanism actuating the final output mechanism.
4. Combinations of features individually covered by group F16H 61/00 and one or both of groups F16H 59/00 and F16H 63/00 are classified in group F16H 61/00.
  5. Combinations of features individually covered by groups F16H 59/00 and F16H 63/00 are classified in group F16H 63/00.
  6. When classifying in groups F16H 59/00-F16H 63/00, control inputs or types of gearing which are not identified by the classification according to Notes (4) and (5), and which are considered to represent information of interest for search, may also be classified. Such non-obligatory classification should be given as "additional information", e.g. selected from subgroup F16H 61/66 relating to the type of gearing controlled or from group F16H 59/00 relating to control inputs.

### **59/00 Control inputs to change-speed- or reversing-gearings for conveying rotary motion [5]**

- 59/02 • *Selector apparatus [5]*
- 59/04 • • *Ratio selector apparatus [5]*
- 59/06 • • • *the ratio being infinitely variable [5]*
- 59/08 • • *Range selector apparatus [5]*
- 59/10 • • • *comprising levers [5]*
- 59/12 • • • *comprising push button devices [5]*
- 59/14 • *Inputs being a function of torque or torque demand [5]*
- 59/16 • • *Dynamometric measurement of torque [5]*
- 59/18 • • *dependent on the position of the accelerator pedal [5]*
- 59/20 • • • *Kickdown [5]*
- 59/22 • • • *Idle position [5]*
- 59/24 • • *dependent on the throttle opening [5]*
- 59/26 • • *dependent on pressure [5]*
- 59/28 • • • *Gasifier pressure in gas turbines [5]*
- 59/30 • • • *Intake manifold vacuum [5]*
- 59/32 • • • *Supercharger pressure in internal combustion engines [5]*
- 59/34 • • *dependent on fuel feed [5]*
- 59/36 • *Inputs being a function of speed [5]*
- 59/38 • • *of gearing elements [5]*
- 59/40 • • • *Output shaft speed [5]*
- 59/42 • • • *Input shaft speed [5]*
- 59/44 • • *dependent on machine speed (F16H 59/46 takes precedence) [5]*

- 59/46 • • dependent on a comparison between speeds [5]
- 59/48 • Inputs being a function of acceleration [5]
- 59/50 • Inputs being a function of the status of the machine, e.g. position of doors or safety belts [5]
- 59/52 • • dependent on the weight of the machine, e.g. change in weight resulting from passengers boarding a bus [5]
- 59/54 • • dependent on signals from the brakes, e.g. parking brakes [5]
- 59/56 • • dependent on signals from the main clutch [5]
- 59/58 • • dependent on signals from the steering [5]
- 59/60 • Inputs being a function of ambient conditions [5]
- 59/62 • • Atmospheric pressure [5]
- 59/64 • • Atmospheric temperature [5]
- 59/66 • • Road conditions, e.g. slope, slippery [5]
- 59/68 • Inputs being a function of gearing status [5]
- 59/70 • • dependent on the ratio established [5]
- 59/72 • • dependent on oil characteristics, e.g. temperature, viscosity [5]
- 59/74 • Inputs being a function of engine parameters (F16H 59/14 takes precedence) [5]
- 59/76 • • Number of cylinders operating [5]
- 59/78 • • Temperature [5]
- 61/00 Control functions within change-speed- or reversing-gearings for conveying rotary motion [5]**
- 61/02 • characterised by the signals used [5]
- 61/04 • Smoothing ratio shift [5]
- 61/06 • • by controlling rate of change of fluid pressure [5]
- 61/08 • • Timing control [5]
- 61/10 • Regulating shift hysteresis [5]
- 61/12 • Detecting malfunction or potential malfunction, e.g. fail safe (in control of hydrostatic gearing F16H 61/4192) [5, 2010.01]
- 61/14 • Control of torque converter lock-up clutches [5]
- 61/16 • Inhibiting shift during unfavourable conditions (F16H 61/18 takes precedence) [5]
- 61/18 • Preventing unintentional or unsafe shift (constructional features of the final output mechanisms F16H 63/30) [5]
- 61/20 • Preventing gear creeping [5]
- 61/21 • Providing engine brake control [7]
- 61/22 • Locking (F16H 63/34 takes precedence) [5]
- 61/24 • Providing feel, e.g. to enable selection [5]
- 61/26 • Generation or transmission of movements for final actuating mechanisms [5]
- Note(s)**
- 1. The generation or transmission of movements comprising only the selector apparatus, is classified in group F16H 59/00.
- 2. The generation or transmission of movements, when part of the final output mechanisms, is classified in group F16H 63/00.
- 61/28 • • with at least one movement of the final actuating mechanism being caused by a non-mechanical force, e.g. power-assisted [5]
- 61/30 • • • Hydraulic motors therefor [5]
- 61/32 • • • Electric motors therefor [5]
- 61/34 • • comprising two mechanisms, one for the preselection movement, and one for the shifting movement (F16H 61/36 takes precedence) [5]
- 61/36 • • with at least one movement being transmitted by a cable [5]
- 61/38 • Control of exclusively fluid gearing [5]
- 61/40 • • hydrostatic (involving modification of the gearing F16H 39/02, F16H 39/04) [5, 2010.01]
- 61/4008 • • • Control of circuit pressure [2010.01]
- 61/4017 • • • • Control of high pressure, e.g. avoiding excess pressure by a relief valve [2010.01]
- 61/4026 • • • • Control of low pressure [2010.01]
- 61/4035 • • • • Control of circuit flow [2010.01]
- 61/4043 • • • • Control of a bypass valve [2010.01]
- 61/4052 • • • • by using a variable restriction, e.g. an orifice valve [2010.01]
- 61/4061 • • • Control related to directional control valves, e.g. change-over valves, for crossing the feeding conduits (forward reverse switching by using swash plate F16H 61/438) [2010.01]
- 61/4069 • • • Valves related to the control of neutral, e.g. shut off valves (zero tilt rotation holding means F16H 61/439) [2010.01]
- 61/4078 • • • Fluid exchange between hydrostatic circuits and external sources or consumers [2010.01]
- 61/4096 • • • • with pressure accumulators [2010.01]
- 61/4104 • • • • Flushing, e.g. by using flushing valves or by connection to exhaust [2010.01]
- 61/4131 • • • • Fluid exchange by aspiration from reservoirs, e.g. sump [2010.01]
- 61/4139 • • • • Replenishing or scavenging pumps, e.g. auxiliary charge pumps [2010.01]
- 61/4148 • • • Open loop circuits [2010.01]
- 61/4157 • • • Control of braking, e.g. preventing pump over-speeding when motor acts as a pump [2010.01]
- 61/4165 • • • Control of cooling or lubricating [2010.01]
- 61/4174 • • • Control of venting, e.g. removing trapped air [2010.01]
- 61/4183 • • • Preventing or reducing vibrations or noise, e.g. avoiding cavitations [2010.01]
- 61/4192 • • • Detecting malfunction or potential malfunction, e.g. fail safe [2010.01]
- 61/42 • • • involving adjustment of a pump or motor with adjustable output or capacity [5, 2010.01]
- 61/421 • • • • Motor capacity control by electro-hydraulic control means, e.g. using solenoid valves [2010.01]
- 61/423 • • • • Motor capacity control by fluid pressure control means [2010.01]
- 61/425 • • • • Motor capacity control by electric actuators [2010.01]
- 61/427 • • • • Motor capacity control by mechanical control means, e.g. by levers or pedals [2010.01]
- 61/431 • • • • Pump capacity control by electro-hydraulic control means, e.g. using solenoid valve [2010.01]
- 61/433 • • • • Pump capacity control by fluid pressure control means [2010.01]
- 61/435 • • • • Pump capacity control by electric actuators [2010.01]
- 61/437 • • • • Pump capacity control by mechanical control means, e.g. by levers or pedals [2010.01]
- 61/438 • • • • Control of forward-reverse switching, e.g. control of the swash plate causing discharge in two directions (using a directional control valve F16H 61/4061) [2010.01]
- 61/439 • • • • Control of the neutral position, e.g. by zero tilt rotation holding means (using a neutral valve or a shutoff valve F16H 61/4069) [2010.01]

## F16H

- 61/44 • • • with more than one pump or motor unit in operation [5]
- 61/444 • • • • by changing the number of pump or motor units in operation [2010.01]
- 61/448 • • • • Control circuits for tandem pumps or motors [2010.01]
- 61/452 • • • • Selectively controlling multiple pumps or motors, e.g. switching between series or parallel [2010.01]
- 61/456 • • • • Control of the balance of torque or speed between pumps or motors (hydrostatic differentials F16H 48/18) [2010.01]
- 61/46 • • • Automatic regulation in accordance with output requirements [5, 2010.01]
- 61/462 • • • • for achieving a target speed ratio [2010.01]
- 61/465 • • • • for achieving a target input speed [2010.01]
- 61/468 • • • • for achieving a target input torque [2010.01]
- 61/47 • • • • for achieving a target output speed [2010.01]
- 61/472 • • • • for achieving a target output torque [2010.01]
- 61/475 • • • • for achieving a target power, e.g. input power or output power [2010.01]
- 61/478 • • • • for preventing overload, e.g. high pressure limitation [2010.01]
- 61/48 • • hydrodynamic [5]
- 61/50 • • • controlled by changing the flow, force, or reaction of the liquid in the working circuit, while maintaining a completely filled working circuit [5]
- 61/52 • • • • by altering the position of blades [5]
- 61/54 • • • • • by means of axially-shiftable blade runners [5]
- 61/56 • • • • • to change the blade angle [5]
- 61/58 • • • • • by change of the mechanical connection of, or between, the runners [5]
- 61/60 • • • • • exclusively by the use of freewheel clutches [5]
- 61/62 • • • • • involving use of a speed-changing gearing or of a clutch in the connection between runners (F16H 45/02, F16H 61/60 take precedence) [5]
- 61/64 • • • controlled by changing the amount of liquid in the working circuit [5]
- 61/66 • specially adapted for continuously variable gearings (F16H 61/38 takes precedence; orbital toothed gearings with a secondary drive in order to vary the speed continuously F16H 3/72) [2006.01]
- 61/662 • • with endless flexible members [2006.01]
- 61/664 • • Friction gearings [2006.01]
- 61/68 • specially adapted for stepped gearings [2006.01]
- 61/682 • • with interruption of drive [2006.01]
- 61/684 • • without interruption of drive [2006.01]
- 61/686 • • • with orbital gears [2006.01]
- 61/688 • • • with two inputs, e.g. selection of one of two torque-flow paths by clutches [2006.01]
- 61/70 • specially adapted for change-speed gearing in group arrangement, i.e. with separate change-speed gear trains arranged in series, e.g. range or overdrive-type gearing arrangements [2006.01]
- 63/00 Control outputs to change-speed- or reversing-gearings for conveying rotary motion [5]**
- 63/02 • Final output mechanisms therefor; Actuating means for the final output mechanisms [5]
- 63/04 • • a single final output mechanism being moved by a single final actuating mechanism [5]
- 63/06 • • • the final output mechanism having an indefinite number of positions [5]
- 63/08 • • Multiple final output mechanisms being moved by a single common final actuating mechanism [5]
- 63/10 • • • the final actuating mechanism having a series of independent ways of movement, each way of movement being associated with only one final output mechanism [5]
- 63/12 • • • • two or more ways of movement occurring simultaneously [5]
- 63/14 • • • the final output mechanisms being successively actuated by repeated movement of the final actuating mechanism [5]
- 63/16 • • • the final output mechanisms being successively actuated by progressive movement of the final actuating mechanism [5]
- 63/18 • • • • the final actuating mechanism comprising cams [5]
- 63/20 • • • with preselection and subsequent movement of each final output mechanism by movement of the final actuating mechanism in two different ways, e.g. guided by a shift gate [5]
- 63/22 • • • • the final output mechanisms being simultaneously moved by the final actuating mechanism [5]
- 63/24 • • each of the final output mechanisms being moved by only one of the various final actuating mechanisms [5]
- 63/26 • • • some of the movements of the final output mechanisms being caused by another final output mechanism [5]
- 63/28 • • two or more final actuating mechanisms moving the same final output mechanism [5]
- 63/30 • • Constructional features of the final output mechanisms [5]
- 63/32 • • • Gear shifter yokes [5]
- 63/34 • • • Locking or disabling mechanisms [5]
- 63/36 • • • • Interlocking devices [5]
- 63/38 • • • Detents [5]
- 63/40 • comprising signals other than signals for actuating the final output mechanisms [5]
- 63/42 • • Ratio indicator devices [5]
- 63/44 • • Signals to the control unit of auxiliary gearing [5]
- 63/46 • • Signals to a clutch outside the gearbox [5]
- 63/48 • • Signals to a parking brake [5]
- 63/50 • • Signals to an engine or motor [7]

## F16J PISTONS; CYLINDERS; PRESSURE VESSELS IN GENERAL; SEALINGS

### Note(s)

Attention is drawn to the following places:

- A47J 27/08.....Pressure cookers
- E04B 1/68.....Sealing building joints

E05C 9/00.....	Multi-point fastening of wings in general
F01B.....	Machines or engines in general or of reciprocating type, e.g. cylinders peculiar to steam engines
	F01B 31/28
F02F 1/00.....	Cylinders for combustion engines
F02F 3/00.....	Pistons for combustion engines
F04D 29/08.....	Sealings of non-positive displacement pumps
F17B 1/04.....	Sealing devices for sliding parts of gas holders of variable capacity
F28F 9/04.....	Arrangements for sealing elements into header boxes or end plates of heat-exchangers.

### Subclass index

PISTONS, TRUNK PISTONS, OR PLUNGERS; PISTON-RODS.....	1/00, 7/00
DIAPHRAGMS, BELLOWS, BELLOWS PISTONS; PISTON-RINGS.....	3/00, 9/00
CYLINDERS, HOLLOW BODIES.....	10/00
PRESSURE VESSELS; COVERS.....	12/00, 13/00
SEALINGS.....	15/00

<b>1/00</b>	<b>Pistons; Trunk pistons; Plungers</b> (bellows pistons F16J 3/06; piston-rings or seats therefor F16J 9/00; rotary pistons, e.g. for "Wankel" type engines, F01C; specific for combustion engines, i.e. constructed to withstand high temperature or modified for guiding, igniting, vaporising, or otherwise treating the charge, F02F; pistons specially adapted for reciprocating-piston liquid engines F03C 1/28; for pumps F04B; floats F16K 33/00)	9/06	• using separate springs expanding the rings; Springs therefor
1/01	• characterised by the use of particular materials (F16J 1/02 takes precedence) [3]	9/08	• with expansion obtained by pressure of the medium
1/02	• Bearing surfaces	9/10	• Special members for adjusting the rings
1/04	• Resilient guiding parts, e.g. skirts, particularly for trunk pistons	9/12	• Details
1/06	• • with separate expansion members; Expansion members	9/14	• • Joint-closures
1/08	• Constructional features providing for lubrication	9/16	• • • obtained by stacking of rings
1/09	• with means for guiding fluids (F16J 1/08 takes precedence) [3]	9/18	• • • with separate bridge-elements
1/10	• Connection to driving members	9/20	• • Rings with special cross-section (L-section rings F16J 9/02); Oil-scraping rings
1/12	• • with piston-rods, i.e. rigid connections	9/22	• • Rings for preventing wear of grooves or like seatings
1/14	• • with connecting-rods, i.e. pivotal connections	9/24	• • Members preventing rotation of rings in grooves
1/16	• • • with gudgeon-pin; Gudgeon-pins	9/26	• characterised by the use of particular materials [3]
1/18	• • • • Securing of gudgeon-pins	9/28	• • of non-metals [3]
1/20	• • • with rolling contact, other than in ball or roller bearings	<b>10/00</b>	<b>Engine or like cylinders</b> (pressure vessels in general F16J 12/00; cylinders for engines or other apparatus of particular kinds, <u>see</u> the appropriate subclasses, e.g. for combustion engines F02F); <b>Features of hollow, e.g. cylindrical, bodies in general</b> [3]
1/22	• • • with universal joint, e.g. ball-joint	10/02	• Cylinders designed to receive moving pistons or plungers [3]
1/24	• • designed to give the piston some rotary movement about its axis	10/04	• • Running faces; Liners [3]
<b>3/00</b>	<b>Diaphragms; Bellows; Bellows pistons</b> (connection of valves to inflatable elastic bodies B60C 29/00; bellows or the like used in instruments G12B 1/04; diaphragms for electromechanical transducers H04R 7/00)	<b>12/00</b>	<b>Pressure vessels in general</b> (covers therefor F16J 13/00; for particular applications, <u>see</u> the relevant subclasses, e.g. B01J, F17C, G21C) [3]
3/02	• Diaphragms [2]	<b>13/00</b>	<b>Covers or similar closure members for pressure vessels in general</b> (for engine or like cylinders F16J 10/00; sealings F16J 15/02; covers for box-like containers B65D 43/00; devices for securing or retaining closure members B65D 45/00; closures for containers not otherwise provided for B65D 51/00; manholes, covers for large containers B65D 90/10; gates or closures for large containers B65D 90/54; for vessels for containing or storing compressed, liquefied or solidified gases F17C 13/06; steam boilers F22B)
3/04	• Bellows [2]	13/02	• Detachable closure members; Means for tightening closures (F16J 13/16, F16J 13/22 take precedence) [3]
3/06	• Bellows pistons [2]	13/04	• • attached with a bridge member
<b>7/00</b>	<b>Piston-rods, i.e. rods rigidly connected to the piston</b> (connecting-rods or like links pivoted at both ends F16C 7/00)	13/06	• • attached only by clamps along the circumference
<b>9/00</b>	<b>Piston-rings, seats therefor; Ring sealings of similar construction in general</b> (other sealings between pistons and cylinders F16J 3/06, F16J 15/16; tools for mounting or removing piston-rings or the like B25B; piston sealing arrangements on brake master cylinders B60T 11/236) [2, 5]	13/08	• • attached by one or more members actuated to project behind a part or parts of the frame (similar constructions for doors or windows E05C 9/00)
9/02	• L-section rings	13/10	• • attached by means of a divided ring
9/04	• Helical rings		

## F16J

- 13/12 • • attached by wedging action by means of screw-thread, interrupted screw-thread, bayonet closure, or the like
- 13/14 • • attached exclusively by spring action or elastic action
- 13/16 • Pivoted closures (F16J 13/22 takes precedence) [3]
- 13/18 • • pivoted directly on the frame
- 13/20 • • mounted by mobile fastening on swinging arms
- 13/22 • with movement parallel to the plane of the opening [3]
- 13/24 • with safety devices, e.g. to prevent opening prior to pressure release [3]
- 15/00 Sealings** (sealing arrangements for vehicle windows, windscreens, non-fixed roofs, doors, or similar devices B60J 10/00; sealing or packing elements for container closures B65D 53/00; sealing arrangements in rotary-piston machines or engines F01C 19/00; sealings in non-positive-displacement machines or engines F01D 11/00; arrangements of sealings in combustion engines F02F 11/00; sealing arrangements in rotary-piston pumps F04C 27/00; sealing lead-in or lead-through insulators H01B 17/30) [5]
  - 15/02 • between relatively-stationary surfaces (F16J 15/46, F16J 15/48 take precedence)
  - 15/04 • • without packing between the surfaces, e.g. with ground surfaces, with cutting edge
  - 15/06 • • with solid packing compressed between sealing surfaces
    - 15/08 • • • with exclusively metal packing
    - 15/10 • • • with non-metallic packing
    - 15/12 • • • • with metal reinforcement or covering
    - 15/14 • • by means of granular or plastic material, or fluid
    - 15/16 • between relatively-moving surfaces (F16J 15/50, F16J 15/52 take precedence; bellows pistons F16J 3/06; piston-rings or ring sealings of similar construction in general F16J 9/00; spindle sealings for valves F16K 41/00) [2]
  - 15/18 • • with stuffing-boxes for elastic or plastic packings
  - 15/20 • • • Packing materials therefor
  - 15/22 • • • • shaped as strands, ropes, threads, ribbons, or the like
  - 15/24 • • • with radially or tangentially compressed packing
  - 15/26 • • with stuffing-boxes for rigid sealing rings
  - 15/28 • • • with sealing rings made of metal
  - 15/30 • • • with sealing rings made of carbon
  - 15/32 • • with elastic sealing lip
  - 15/34 • • with slip-ring pressed against a more or less radial face on one member
    - 15/36 • • • connected by a diaphragm to the other member
    - 15/38 • • • sealed by a packing [2]
    - 15/40 • • by means of fluid
    - 15/42 • • • kept in sealing position by centrifugal force
    - 15/43 • • • kept in sealing position by magnetic force [6]
    - 15/44 • Free-space packings
    - 15/447 • • Labyrinth packings [3]
    - 15/453 • • characterised by the use of particular materials [3]
  - 15/46 • with packing ring expanded or pressed into place by fluid pressure, e.g. inflatable packings (connection of valves to inflatable elastic bodies B60C 29/00; specially adapted for tube connections F16L)
  - 15/48 • • influenced by the pressure within the member to be sealed
  - 15/50 • between relatively-movable members, by means of a sealing without relatively-moving surfaces, e.g. fluid-tight sealings for transmitting motion through a wall
  - 15/52 • • by means of sealing bellows or diaphragms (connection of valves to inflatable elastic bodies B60C 29/00)
  - 15/53 • using magnetic means [6]
  - 15/54 • Other sealings for rotating shafts
  - 15/56 • Other sealings for reciprocating rods

## F16K VALVES; TAPS; COCKS; ACTUATING-FLOATS; DEVICES FOR VENTING OR AERATING

### Note(s)

1. Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".
2. Attention is drawn to Note (2) following the title of subclass G05D and also the subdivisions of that subclass, according to which pressure regulators and flow regulators, e.g. flow regulating valves with pressure compensator, even with the whole regulating system contained in a valve, operating with or without auxiliary power, are covered by groups G05D 16/00 or G05D 7/00, respectively. However, details of the valve parts, per se, are classified in the appropriate groups of this subclass.
3. Attention is drawn to the following places:
  - A47J 27/09.....Safety devices for pressure cookers
  - A47J 31/46.....Dispensing spouts, drain valves or like beverage-making apparatus
  - A61B 5/0235.....Valves specially adapted for measuring pressure in heart or blood vessels
  - A61F 2/24.....Heart valves
  - A61M 16/20.....Valves specially adapted for medical respiratory devices
  - A61M 39/00.....Tube connectors, tube couplings, valves or branch units specially adapted for medical use in general
  - A62B 9/02.....Valves for respiratory apparatus
  - A62B 18/10.....Valves for breathing masks or helmets
  - A62C.....Fire extinguishers
  - B05B.....Nozzles, spray heads or other discharge apparatus for spraying or atomising
  - B60C 29/00.....Arrangements of tyre-inflating valves relative to tyres or wheel rims; Connection of valves to wheel rims, tyres or other inflatable elastic bodies
  - B60G 17/048.....Valves specially adapted for adjusting vehicle fluid-spring characteristics
  - B60T.....Valves specially adapted for vehicle brake control systems
  - B62D 5/08.....Vehicle power-assisted steering characterised by the type of valve used
  - B63B 7/00, B63C 9/00.....Arrangement of inflating valves for floatable live-saving equipment
  - B65D 47/04.....Container closures with discharging valves

B65D 83/28, B65D 83/44.....	Nozzles or valves specially adapted for aerosol containers
B65D 90/32.....	Safety valves for large containers
B65D 90/54.....	Gates or closures on large containers
B67C 3/28.....	Flow control devices for bottling liquids
B67D.....	Dispensing, delivering or transferring liquids
E02B 8/00.....	Details, e.g. valves, of barrages or weirs
E02B 13/02.....	Closures for irrigation conduits
E03B 9/02.....	Arrangement of valves in hydrants
E03D.....	Flushing valves for water-closets or urinals
E05F 3/12.....	Valve arrangement in door closers
E21B 21/10.....	Valve arrangements in drilling-fluid circulation systems
E21B 34/00.....	Valve arrangements for boreholes or wells
F01B 25/10.....	Working-fluid valves for controlling machines or engines in general or of positive-displacement type
F01D 17/10.....	Final actuators for controlling non-positive displacement machines or engines
F01L.....	Cyclically operated valves for machines or engines
F02D 9/08.....	Throttle valves for controlling combustion engines
F02K 9/58.....	Propellant feed valves for rocket-engines
F02M.....	Carburettors, fuel injection
F02M 59/46.....	Valves for fuel injection pumps
F04.....	Pumps
F16F 9/34.....	Valves for shock absorbers
F16L 29/00, F16L 37/28.....	Pipe joints or quick-acting couplings with fluid cut-off means
F16L 55/00.....	Arrangement of valves in pipes
F16L 55/055.....	Valves specially adapted to prevent or minimise the effect of water hammer
F16L 55/46.....	Launching devices for pigs or moles
F16N 23/00.....	Check valves for lubrication systems
F17C 13/04.....	Arrangement of valves in pressure vessels
F22B 37/44.....	Arrangement of safety valves on steam boilers
F22D 5/34.....	Application of valves to automatic water-feed in boiler
F23L 13/00.....	Valves for air supply control to burners
F23Q 2/173.....	Valves for lighters with gaseous fuel and adjustable flame
F24C 3/12, F24C 5/16.....	Arrangement of valves on stoves or ranges
F24F.....	Air conditioning; Ventilation
F25B 41/04.....	Disposition of fluid circulation valves in refrigeration machines
G05D.....	Controlling non-electric variables
G10B 3/06.....	Valves for organs
G10D 9/04.....	Valves for other wind-actuated musical instruments.

### **Subclass index**

#### **CONSTRUCTIONAL TYPES**

Lift-valves, gate valves or sliding valves, taps, diaphragm cut-off apparatus.....	1/00-7/00
Multiple-way valves.....	11/00
Other constructional types of cut-off apparatus, arrangements for cutting off.....	13/00

#### **FUNCTIONAL TYPES**

Check valves; safety or equalising valves; arrangements for mixing fluids.....	15/00, 17/00, 11/00
Fluid-delivery valves; valves for preventing drip from nozzles.....	21/00, 23/00
For venting or aerating enclosures.....	24/00

#### **DETAILS OR GENERAL MEANS**

Handling or control.....	29/00, 31/00, 39/00, 43/00
Auxiliary means.....	47/00, 49/00
Safety.....	35/00, 37/00
Details: contact between valve members and seats, housings, floats, sealings.....	25/00, 27/00, 33/00, 41/00
Other details.....	51/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

### **Constructional types**

#### **Note(s)**

In groups F16K 1/00-F16K 13/00, an initial seal breaking or final sealing movement which is different from the opening or closing movement of the valve is not considered in determining the movement to be classified.

<b>1/00</b>	<b>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 (diaphragm valves F16K 7/00)</b>
1/02	• with screw-spindle (F16K 1/12-F16K 1/28 take precedence; actuating mechanisms with screw-spindles F16K 31/50)
1/04	• • with a cut-off member rigid with the spindle, e.g. main valves
1/06	• • Special arrangements for improving the flow, e.g. special shape of passages or casings

- 1/08 • • • in which the spindle is perpendicular to the general direction of flow
- 1/10 • • • in which the spindle is inclined to the general direction of flow
- 1/12 • with streamlined valve member around which the fluid flows when the valve is opened
- 1/14 • with ball-shaped valve members (check valves F16K 15/04)
- 1/16 • with pivoted closure members
- 1/18 • • with pivoted discs or flaps
- 1/20 • • • with axis of rotation arranged externally of valve member
- 1/22 • • • with axis of rotation crossing the valve member, e.g. butterfly valves
- 1/226 • • • • Shape or arrangement of the sealing
- 1/228 • • • • Movable sealing bodies
- 1/24 • with valve members that, on opening of the valve, are initially lifted from the seat and next are turned around an axis parallel to the seat
- 1/26 • • Shape or arrangement of the sealing
- 1/28 • • • Movable sealing bodies
- 1/30 • specially adapted for pressure containers
- 1/32 • Details (details of more general applicability F16K 25/00-F16K 51/00)
- 1/34 • • Cutting-off parts (F16K 1/06, F16K 1/12, F16K 1/14, F16K 1/26 take precedence)
- 1/36 • • • Valve members (for double-seat valves F16K 1/44)
- 1/38 • • • • of conical shape
- 1/40 • • • • of helical shape
- 1/42 • • • Valve seats (for double-seat valves F16K 1/44)
- 1/44 • • • Details of seats or valve members of double-seat valves
- 1/46 • • • Attachment of sealing rings
- 1/48 • • Attaching valve members to valve-spindles [4]
- 1/50 • • Preventing rotation of valve members
- 1/52 • • Means for additional adjustment of the rate of flow
- 1/54 • • Arrangements for modifying the way in which the rate of flow varies during the actuation of the valve
  
- 3/00 Gate valves or sliding valves, i.e. cut-off apparatus with closing members having a sliding movement along the seat for opening and closing (F16K 5/00 takes precedence; in barrages or weirs E02B 8/04)**
- 3/02 • with flat sealing faces; Packings therefor
- 3/03 • • with a closure member in the form of an iris-diaphragm
- 3/04 • • with pivoted closure members
- 3/06 • • • in the form of closure plates arranged between supply and discharge passages (F16K 3/10 takes precedence)
- 3/08 • • • • with circular closure plates rotatable around their centres
- 3/10 • • • with special arrangements for separating the sealing faces or for pressing them together
- 3/12 • • with wedge-shaped arrangements of sealing faces
- 3/14 • • • with special arrangements for separating the sealing faces or for pressing them together
- 3/16 • • with special arrangements for separating the sealing faces or for pressing them together (F16K 3/10, F16K 3/14 take precedence)
- 3/18 • • • by movement of the closure members
- 3/20 • • • by movement of the seats
  
- 3/22 • with sealing faces shaped as surfaces of solids of revolution (F16K 13/02 takes precedence; with resilient valve members F16K 3/28)
- 3/24 • • with cylindrical valve members
- 3/26 • • • with fluid passages in the valve member
- 3/28 • with resilient valve members
- 3/30 • Details
- 3/312 • • Line blinds
- 3/314 • • Forms or constructions of slides; Attachment of the slide to the spindle
- 3/316 • • Guiding of the slide
- 3/32 • • Means for additional adjustment of the rate of flow
- 3/34 • • Arrangements for modifying the way in which the rate of flow varies during the actuation of the valve
- 3/36 • • Features relating to lubrication
  
- 5/00 Taps or cocks comprising only cut-off apparatus having at least one of the sealing faces shaped as a more or less complete surface of a solid of revolution, the opening and closing movement being predominantly rotary (taps of the lift-valve type F16K 1/00)**
- 5/02 • with plugs having conical surfaces; Packings therefor
- 5/04 • with plugs having cylindrical surfaces; Packings therefor
- 5/06 • with plugs having spherical surfaces; Packings therefor
- 5/08 • Details
- 5/10 • • Means for additional adjustment of the rate of flow
- 5/12 • • Arrangements for modifying the way in which the rate of flow varies during the actuation of the valve
- 5/14 • • Special arrangements for separating the sealing faces or for pressing them together
- 5/16 • • • for plugs with conical surfaces
- 5/18 • • • for plugs with cylindrical surfaces
- 5/20 • • • for plugs with spherical surfaces
- 5/22 • • Features relating to lubrication
  
- 7/00 Diaphragm cut-off apparatus, e.g. with a member deformed, but not moved bodily, to close the passage (container gates or closures operating by deformation of flexible walls B65D 90/56; means for plugging pipes or hoses F16L 55/10)**
- 7/02 • with tubular diaphragm
- 7/04 • • constrictable by external radial force
- 7/06 • • • by means of a screw-spindle, cam, or other mechanical means
- 7/07 • • • by means of fluid pressure
- 7/08 • • constrictable by twisting
- 7/10 • with inflatable member
- 7/12 • with flat, dished, or bowl-shaped diaphragm
- 7/14 • • arranged to be deformed against a flat seat
- 7/16 • • • the diaphragm being mechanically actuated, e.g. by screw-spindle or cam
- 7/17 • • • the diaphragm being actuated by fluid pressure
- 7/18 • with diaphragm secured at one side only, e.g. to be laid on the seat by rolling action
- 7/20 • with a compressible solid closure member
  
- 11/00 Multiple-way valves, e.g. mixing valves; Pipe fittings incorporating such valves; Arrangement of valves and flow lines specially adapted for mixing fluid [4]**
- 11/02 • with all movable sealing faces moving as one unit

- 11/04 • • comprising only lift valves
- 11/044 • • • with movable valve members positioned between valve seats [4]
- 11/048 • • • with valve seats positioned between movable valve members [4]
- 11/052 • • • with pivoted closure members, e.g. butterfly valves [4]
- 11/056 • • • with ball-shaped valve members [4]
- 11/06 • • comprising only sliding valves
- 11/065 • • • with linearly sliding closure members [4]
- 11/07 • • • • with cylindrical slides [4]
- 11/072 • • • • with pivoted closure members [4]
- 11/074 • • • • with flat sealing faces [4]
- 11/076 • • • • with sealing faces shaped as surfaces of solids of revolution [4]
- 11/078 • • • with pivoted and linearly movable closure members [4]
- 11/08 • • comprising only taps or cocks
- 11/083 • • • with tapered plug [2]
- 11/085 • • • with cylindrical plug [2]
- 11/087 • • • with spherical plug [2]
- 11/10 • with two or more closure members not moving as a unit
- 11/12 • • with one plug turning in another
- 11/14 • • operated by one actuating member, e.g. a handle (with one plug turning in another F16K 11/12)
- 11/16 • • • which only slides, or only turns, or only swings in one plane
- 11/18 • • • with separate operating movements for separate closure members
- 11/20 • • operated by separate actuating members (with one plug turning in another F16K 11/12)
- 11/22 • • • with an actuating member for each valve, e.g. interconnected to form multiple-way valves
- 11/24 • • • with an electromagnetically-operated valve, e.g. for washing machines
- 13/00 Other constructional types of cut-off apparatus** (means for plugging pipes or hoses F16L 55/10); **Arrangements for cutting-off [4]**
- 13/02 • with both sealing faces shaped as small segments of a cylinder and the moving member pivotally mounted
- 13/08 • Arrangements for cutting-off [4]
- 13/10 • • by means of liquid or granular medium [4]

### **Functional types**

- 15/00 Check valves** (valves specially adapted for inflatable balls A63B 41/00)
- 15/02 • with guided rigid valve members
- 15/03 • • with a hinged closure member
- 15/04 • • shaped as balls
- 15/06 • • with guided stems
- 15/08 • • shaped as rings
- 15/10 • • • integral with, or rigidly fixed to, a common valve plate
- 15/12 • • • Springs for ring valves [3]
- 15/14 • with flexible valve members
- 15/16 • • with tongue-shaped laminae
- 15/18 • with actuating mechanism; Combined check valves and actuated valves
- 15/20 • specially designed for inflatable bodies, e.g. tyres (connecting valves to inflatable elastic bodies B60C 29/00)
- 17/00 Safety valves; Equalising valves** (pressure relief devices for aerosol containers B65D 83/70)
- 17/02 • opening on surplus pressure on one side; closing on insufficient pressure on one side (check valves F16K 15/00)
- 17/04 • • spring-loaded
- 17/06 • • • with special arrangements for adjusting the opening pressure
- 17/08 • • • with special arrangements for providing a large discharge passage
- 17/10 • • • with auxiliary valve for fluid operation of the main valve
- 17/12 • • weight-loaded
- 17/14 • • with fracturing member
- 17/16 • • • with fracturing diaphragm
- 17/164 • • and remaining closed after return of the normal pressure
- 17/168 • • combined with manually-controlled valves, e.g. a valve combined with a safety valve
- 17/18 • opening on surplus pressure on either side
- 17/19 • • Equalising valves predominantly for tanks
- 17/192 • • • with closure member in the form of a movable liquid column
- 17/194 • • • weight-loaded
- 17/196 • • • spring-loaded
- 17/20 • Excess-flow valves (actuated in consequence of shock or similar extraneous influence F16K 17/36)
- 17/22 • • actuated by the difference of pressure between two places in the flow line
- 17/24 • • • acting directly on the cutting-off member
- 17/26 • • • • operating in either direction
- 17/28 • • • • operating in one direction only
- 17/30 • • • • • spring-loaded
- 17/32 • • • acting on a servo-mechanism or on a catch-releasing mechanism
- 17/34 • • in which the flow-energy of the flowing medium actuates the closing mechanism
- 17/36 • actuated in consequence of extraneous circumstances, e.g. shock, change of position
- 17/38 • • of excessive temperature
- 17/40 • with fracturing member, e.g. fracturing diaphragm, fusible joint (valves with fracturing member opening on surplus pressure on one side F16K 17/14)
- 17/42 • Valves preventing penetration of air in the outlet of containers for liquids
- 21/00 Fluid-delivery valves** (specially adapted for aerosol containers B65D 83/44; for liquid handling B67D; for flushing devices for water-closets or the like E03D)
- 21/02 • providing a continuous small flow
- 21/04 • Self-closing valves, i.e. closing automatically after operation
- 21/06 • • in which the closing movement, either retarded or not, starts immediately after opening
- 21/08 • • • with ball-shaped closing members
- 21/10 • • • with hydraulic brake cylinder acting on the closure member
- 21/12 • • • with hydraulically-operated opening means; with arrangements for pressure relief before opening
- 21/14 • • with special means for preventing the self-closing
- 21/16 • • closing after a predetermined quantity of fluid has been delivered (F16K 21/10 takes precedence)
- 21/18 • • closed when a rising liquid reaches a predetermined level (float-actuated valves F16K 31/18)

## F16K

- 21/20 • • • by means making use of air-suction through an opening closed by the rising liquid

### 23/00 Valves for preventing drip from nozzles

**24/00 Devices, e.g. valves, for venting or aerating enclosures** (equalising valves F16K 17/00; arrangement or mounting in pipes or pipe systems F16L 55/07; venting or aerating as an additional function of steam traps or like apparatus F16T; ventilation of rooms, vehicles, see the appropriate subclass, e.g. F24F) [2]

- 24/02 • the enclosure being itself a valve, tap, or cock [2]
- 24/04 • for venting only (F16K 24/02 takes precedence) [2]
- 24/06 • for aerating only (F16K 24/02 takes precedence) [2]

## Details

### Note(s)

Details not provided for in groups F16K 25/00-F16K 51/00 are classified in groups F16K 1/00-F16K 24/00.

**25/00 Details relating to contact between valve members and seats** (movement of valve members other than for opening and closing F16K 29/00; sealing constructions, see the appropriate groups according to the type of valve)

- 25/02 • Arrangements using fluid issuing from valve members or seats
- 25/04 • Arrangements for preventing erosion, not otherwise provided for

**27/00 Construction of housings** (methods for welding housings B23K); **Use of materials therefor**

- 27/02 • of lift valves (for reducing the flow resistance of screw-spindle lift-valves F16K 1/06)
- 27/04 • of sliding valves
- 27/06 • of taps or cocks
- 27/07 • of cutting-off parts of tanks, e.g. tank-cars [4]
- 27/08 • Guiding yokes for spindles; Means for closing housings; Dust caps, e.g. for tyre valves
- 27/10 • Welded housings
- 27/12 • Covers for housings

**29/00 Arrangements for movement of valve members other than for opening or closing the valve, e.g. for grinding-in, for preventing sticking**

- 29/02 • providing for continuous motion

**31/00 Operating means; Releasing devices**

- 31/02 • electric; magnetic
- 31/04 • • using a motor
- 31/05 • • • specially adapted for operating hand-operated valves or for combined motor and hand operation
- 31/06 • • using a magnet
- 31/08 • • • using a permanent magnet
- 31/10 • • • with additional mechanism between armature and closure member
- 31/11 • • • • with additional hand operating means [2]
- 31/12 • actuated by fluid (fluid-actuated check valves F16K 15/00; fluid-actuated safety valves F16K 17/00)
- 31/122 • the fluid acting on a piston (F16K 31/143, F16K 31/163, F16K 31/363, F16K 31/383 take precedence) [2]
- 31/124 • • • servo actuated [2]

- 31/126 • • the fluid acting on a diaphragm, bellows, or the like (F16K 31/145, F16K 31/165, F16K 31/365, F16K 31/385 take precedence) [2]

- 31/128 • • • servo actuated [2]

- 31/14 • • for mounting on, or in combination with, hand-actuated valves

- 31/143 • • • the fluid acting on a piston

- 31/145 • • • the fluid acting on a diaphragm

- 31/16 • • with a mechanism, other than pulling- or pushing-rod, between fluid motor and closure member (with float F16K 31/18)

- 31/163 • • • the fluid acting on a piston

- 31/165 • • • the fluid acting on a diaphragm

- 31/18 • • actuated by a float (floats F16K 33/00; float-actuated valves in steam-traps F16T 1/20, in boilers F22D 5/08)

- 31/20 • • • actuating a lift valve

- 31/22 • • • • with the float rigidly connected to the valve

- 31/24 • • • • with a transmission with parts linked together from a single float to a single valve

- 31/26 • • • • • with the valve guided for rectilinear movement and the float attached to a pivoted arm

- 31/28 • • • • with two or more floats actuating one valve

- 31/30 • • • actuating a gate valve or sliding valve

- 31/32 • • • actuating a tap or cock

- 31/34 • • • acting on pilot valve controlling the cut-off apparatus

- 31/36 • • in which fluid from the conduit is constantly supplied to the fluid motor

- 31/363 • • • the fluid acting on a piston (F16K 31/38 takes precedence)

- 31/365 • • • the fluid acting on a diaphragm

- 31/38 • • • in which the fluid works directly on both sides of the fluid motor, one side being connected by means of a restricted passage and the motor being actuated by operating a discharge from that side (F16K 31/40 takes precedence)

- 31/383 • • • • the fluid acting on a piston

- 31/385 • • • • the fluid acting on a diaphragm

- 31/40 • • • with electrically-actuated member in the discharge of the motor

- 31/42 • • by means of electrically-actuated members in the supply or discharge conduits of the fluid motor (F16K 31/40 takes precedence)

- 31/44 • Mechanical actuating means

- 31/46 • • for remote operation

- 31/48 • • actuated by mechanical timing-device, e.g. with dash-pot (self-closing valves F16K 21/16)

- 31/50 • • with screw-spindle

- 31/52 • • with crank, eccentric, or cam

- 31/524 • • • with a cam

- 31/528 • • • with pin and slot

- 31/53 • • with toothed gearing

- 31/54 • • • with pinion and rack

- 31/56 • • without stable intermediate position, e.g. with snap action

- 31/58 • • comprising a movable discharge-nozzle

- 31/60 • • Handles

- 31/62 • • Pedals or like operating members, e.g. actuated by knee or hip

- 31/64 • responsive to temperature variation (dependant on excessive temperature F16K 17/38; control of fire-fighting equipment A62C 37/00; devices for preventing bursting of water pipes by freezing E03B 7/10) [4]

31/66	• • electrically or magnetically actuated, e.g. by magnets with variable magnetic characteristics [4]	41/12	• • with approximately flat diaphragm
31/68	• • actuated by fluid pressure or volumetric variation in a confined chamber [4]	41/14	• with conical flange on the spindle which co-operates with a conical surface in the housing
31/70	• • mechanically actuated, e.g. by a bimetallic strip [4]	41/16	• with a flange on the spindle which rests on a sealing ring
31/72	• Operating means or releasing devices specifically adapted to enhance the speed of valve response [4]	41/18	• • sealing only when the closure member is in the opened position
<b>33/00</b>	<b>Floats for actuation of valves or other apparatus</b>	<b>43/00</b>	<b>Auxiliary closure means in valves, which in case of repair, e.g. rewashing, of the valve, can take over the function of the normal closure means; Devices for temporary replacement of parts of valves for the same purpose</b>
<b>35/00</b>	<b>Means to prevent accidental or unauthorised actuation</b>	<b>47/00</b>	<b>Means in valves for absorbing fluid energy</b> (for pipes F16L 55/00)
35/02	• to be locked or disconnected by means of a push or pull	47/02	• for preventing water-hammer or noise
35/04	• yieldingly resisting the actuation	47/04	• for decreasing pressure, the throttle being incorporated in the closure member
35/06	• using a removable actuating or locking member, e.g. a key (F16K 35/10, F16K 35/12 take precedence)	47/06	• • with a throttle in the form of a helical channel
35/08	• requiring setting according to a code, e.g. permutation locks	47/08	• for decreasing pressure and having a throttling member separate from the closure member
35/10	• with locking caps or locking bars	47/10	• • in which the medium in one direction must flow through the throttling channel, and in the other direction may flow through a much wider channel parallel to the throttling channel
35/12	• with sealing wire	47/12	• • the throttling channel being of helical form
35/14	• interlocking two or more valves	47/14	• • the throttling member being a perforated membrane
35/16	• with locking member actuated by magnet	47/16	• • the throttling member being a cone
<b>37/00</b>	<b>Special means in or on valves or other cut-off apparatus for indicating or recording operation thereof, or for enabling an alarm to be given</b>	<b>49/00</b>	<b>Means in or on valves for heating or cooling</b> (for pipes F16L 53/00; thermal insulation in connection with pipes or pipe systems F16L 59/16)
<b>39/00</b>	<b>Devices for relieving the pressure on the sealing faces</b>	<b>51/00</b>	<b>Other details not peculiar to particular types of valves or cut-off apparatus</b>
39/02	• for lift valves	51/02	• specially adapted for high-vacuum installations [2]
39/04	• for sliding valves		
39/06	• for taps or cocks		
<b>41/00</b>	<b>Spindle sealings</b>		
41/02	• with stuffing-box		
41/04	• • with at least one ring of rubber or like material between spindle and housing		
41/06	• • with at least one ring attached to both spindle and housing		
41/08	• • with at least one ring provided with axially-protruding peripheral closing-lip		
41/10	• with diaphragm, e.g. shaped as bellows or tube	<b>99/00</b>	<b>Subject matter not provided for in other groups of this subclass [2006.01]</b>
<b>F16L</b>	<b>PIPES; JOINTS OR FITTINGS FOR PIPES; SUPPORTS FOR PIPES, CABLES OR PROTECTIVE TUBING; MEANS FOR THERMAL INSULATION IN GENERAL</b>		

**Note(s)**

- In this subclass, the following terms are used with the meanings indicated:
  - "pipe" means a conduit of closed cross-section, which is specially adapted to convey fluids, materials or objects;
  - "hose" means a pipe, as defined above, which has flexibility as an essential characteristic.
- Attention is drawn to the following places:
  - A61M 39/00.....Tube connectors, tube couplings or branch units, specially adapted for medical use
  - B05B 1/20.....Perforated pipes
  - B63B 35/03.....Pipe-laying vessels
  - B64D 39/04.....Adaptation of hose constructions for refuelling aircraft during flight
  - B67D 7/38.....Arrangements of hoses in apparatus for transferring liquids, e.g. fuel, from bulk to vehicles or portable containers
  - E01D 19/10.....Fastening of pipes or cables to bridges
  - E03B.....Water supply installations
  - E03D 11/17.....Means for connecting water-closet bowls to the flushing pipe
  - E03D 11/18.....Siphons for water-closets
  - E03F 3/04.....Pipes or fittings specially adapted to sewers
  - E04D 13/08.....Down pipes for roof drainage; Clamping means therefor
  - E04F 17/00.....Vertical ducts, channels in buildings, e.g. chimneys

E21F 1/04.....Air ducts for ventilation of mines or tunnels; Connections therefor  
 E21F 17/02.....Suspension devices for tubes or the like in mines or tunnels  
 F01N.....Gas flow silencers or exhaust apparatus for machines or engines  
 F16N 21/00.....Conduits, junctions for lubrication systems  
 F17C 3/02.....Thermal insulation of vessels not under pressure for storing liquified or solidified gases, e.g. Dewar flask  
 F22B 37/10.....Water tubes of steam boilers  
 F23J 13/04.....Joints, connections for chimneys or flues  
 F24H 9/12.....Connecting circulation pipes to heaters  
 F28F 9/04.....Arrangements for sealing elements into header boxes or end plates of heat-exchangers  
 G21C 15/22.....Structural association of coolant tubes with headers or other pipes in nuclear reactors  
 H02G 3/04.....Protective tubing or conduits for electric cables  
 H02G 3/30.....Installations of electric cables or lines on walls, floors or ceilings  
 H02G 3/36.....Installations of electric cables or lines in walls, floors or ceilings

**Subclass index**

LAYING OR RECLAIMING PIPES..... 1/00  
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 PIPE JOINTS  
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 PIPING UNITS  
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<p><b>1/00 Laying or reclaiming pipes; Repairing or joining pipes on or under water</b> (soldering or welding B23K; lifting-gear and load-engaging elements B66; hydraulic installations, soil drainage E02B; excavations or underwater constructions E02D; machines for digging trenches in combination with pipe-assembly E02F; laying sewer pipes E03F 3/06; in earth boreholes or wells E21B; tunnelling E21D; laying electric, or combined optical and electric, cables H02G; making special pipe joints, <u>see</u> the relevant groups for the joints) [2, 5, 6]</p> <p>1/024 • Laying or reclaiming pipes on land, e.g. above the ground (F16L 1/12 takes precedence) [5]</p> <p>1/026 • • in or on a frozen surface [6]</p> <p>1/028 • • in the ground (F16L 1/026 takes precedence) [5, 6]</p> <p>1/032 • • • the pipes being continuous (F16L 1/038 takes precedence) [5, 6]</p> <p>1/036 • • • the pipes being composed of sections of short length (F16L 1/038 takes precedence) [5, 6]</p> <p>1/038 • • • the pipes being made <i>in situ</i> [6]</p> <p>1/06 • • Accessories therefor, e.g. anchors [5]</p>	<p>1/09 • • • for bringing two tubular members closer to each other [6]</p> <p>1/10 • • • for aligning [5]</p> <p>1/11 • • • for the detection or protection of pipes in the ground [6]</p> <p>1/12 • Laying or reclaiming pipes on or under water (buoyant hoses F16L 11/133) [5]</p> <p>1/14 • • between the surface and the bottom [5]</p> <p>1/15 • • • vertically [6]</p> <p>1/16 • • on the bottom [5]</p> <p>1/18 • • • the pipes being S- or J-shaped and under tension during laying [5]</p> <p>1/19 • • • • the pipes being J-shaped [6]</p> <p>1/20 • • Accessories therefor, e.g. floats, weights (buoys B63B 22/00) [5]</p> <p>1/225 • • • Stingers [6]</p> <p>1/23 • • • Pipe tensioning apparatus [6]</p> <p>1/235 • • • Apparatus for controlling the pipe during laying [6]</p> <p>1/24 • • • Floats; Weights [5]</p>
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- 1/26 • Repairing or joining pipes on or under water (buoyant hoses F16L 11/133; joints per se F16L 13/00-F16L 49/00) [5]
- 3/00 Supports for pipes, cables or protective tubing, e.g. hangers, holders, clamps, cleats, clips, brackets** (anchors for holding pipes on or under the ground F16L 1/06; noise absorbers in the form of specially adapted hangers or supports F16L 55/035; arrangements specially adapted for supporting insulated bodies F16L 59/12) [5, 7]
- 3/01 • for supporting or guiding the pipes, cables or protective tubing, between relatively movable points, e.g. movable channels (hauling- or hoisting-chains with arrangements for holding electric cables, hoses or the like F16G 13/16) [5]
- 3/015 • • using articulated- or supple-guiding elements (arrangements for cranes or means for transmitting pneumatic, hydraulic or electric power to movable parts or devices B66C 13/12) [6]
- 3/02 • partly surrounding the pipes, cables or protective tubing (bands or chains F16L 3/14)
- 3/04 • • and pressing it against a wall or other support
- 3/06 • • with supports for wires
- 3/08 • substantially surrounding the pipe, cable or protective tubing
- 3/10 • • divided, i.e. with two members engaging the pipe, cable or protective tubing
- 3/11 • • • and hanging from a pendant (F16L 3/14 takes precedence) [5]
- 3/12 • • comprising a member substantially surrounding the pipe, cable or protective tubing
- 3/123 • • • and extending along the attachment surface [5]
- 3/127 • • • and extending away from the attachment surface [5]
- 3/13 • • • and engaging it by snap action [5]
- 3/133 • • • and hanging from a pendant (F16L 3/14 takes precedence) [5]
- 3/137 • • • and consisting of a flexible band [5]
- 3/14 • Hangers in the form of bands or chains
- 3/16 • with special provision allowing movement of the pipe (F16L 3/01 takes precedence; supporting pipes or cables inside other pipes or sleeves F16L 7/00) [5]
- 3/18 • • allowing movement in axial direction
- 3/20 • • allowing movement in transverse direction
- 3/202 • • • the transverse movement being converted to a rotational movement (F16L 3/215 takes precedence) [6]
- 3/205 • • • having supporting springs [5]
- 3/21 • • • • providing constant supporting spring force [5]
- 3/215 • • • the movement being hydraulically or electrically controlled [5]
- 3/217 • • • • hydraulically [6]
- 3/22 • specially adapted for supporting a number of parallel pipes at intervals [6]
- 3/223 • • each support having one transverse base for supporting the pipes (F16L 3/23, F16L 3/237 take precedence) [6]
- 3/227 • • • each pipe being supported by a separate element fastened to the base [6]
- 3/23 • • for a bundle of pipes or a plurality of pipes placed side by side in contact with each other (F16L 3/237 takes precedence) [6]
- 3/233 • • • by means of a flexible band [6]
- 3/237 • • for two pipes [6]
- 3/24 • with special member for attachment to profiled girders
- 3/26 • specially adapted for supporting the pipes all along their length, e.g. pipe channels or ducts [6]
- 5/00 Devices for use where pipes, cables or protective tubing pass through walls or partitions** (installations of electric cables or lines through walls, floors or ceilings H02G 3/22)
- 5/02 • Sealing
- Note(s)**  
Group F16L 5/14 takes precedence over groups F16L 5/04-F16L 5/12.
- 5/04 • • to form a firebreak device [6]
- 5/06 • • by means of a swivel nut compressing a ring or sleeve [6]
- 5/08 • • by means of axial screws compressing a ring or sleeve [6]
- 5/10 • • by using sealing rings or sleeves only [6]
- 5/12 • • the pipe being cut in two pieces [6]
- 5/14 • • for double-walled or multi-channel pipes [6]
- 7/00 Supporting pipes or cables inside other pipes or sleeves, e.g. for enabling pipes or cables to be inserted or withdrawn from under roads or railways without interruption of traffic** (sleeves for supporting pipes, cables or protective tubing, between relatively movable points F16L 3/01) [5]
- 7/02 • and sealing the pipes or cables inside the other pipes, cables or sleeves [6]
- Pipes**
- 9/00 Rigid pipes**
- 9/01 • of wood (F16L 9/16-F16L 9/22 take precedence) [6]
- 9/02 • of metal (F16L 9/16-F16L 9/22 take precedence; finned pipes F28F)
- 9/04 • • Reinforced pipes
- 9/06 • • Corrugated pipes
- 9/08 • of concrete, cement, or asbestos cement, with or without reinforcement (F16L 9/16-F16L 9/22 take precedence)
- 9/10 • of glass or ceramics, e.g. clay, clay tile, porcelain (F16L 9/16-F16L 9/22 take precedence)
- 9/12 • of plastics with or without reinforcement (F16L 9/16-F16L 9/22 take precedence)
- 9/127 • • the walls consisting of a single layer [5]
- 9/128 • • • Reinforced pipes [6]
- 9/133 • • the walls consisting of two layers [5]
- 9/14 • Compound tubes, i.e. made of materials not wholly covered by any one of the preceding groups (F16L 9/16-F16L 9/22 take precedence)
- 9/147 • • comprising only layers of metal and plastics with or without reinforcement [6]
- 9/153 • • comprising only layers of metal and concrete with or without reinforcement [6]
- 9/16 • wound from sheets or strips, with or without reinforcement
- 9/17 • obtained by bending a sheet longitudinally and connecting the edges [6]
- 9/18 • Double-walled pipes; Multi-channel pipes or pipe assemblies (joints therefor F16L 39/00)
- 9/19 • • Multi-channel pipes or pipe assemblies [4]
- 9/21 • made of sound-absorbing materials or with sound-absorbing structure [7]

## F16L

- 9/22 • Pipes composed of a plurality of segments
- 11/00 Hoses, i.e. flexible pipes** (hose-like supports for pipes, cables or protective tubing, between relatively movable points F16L 3/01; suction-cleaner hoses A47L 9/24) [5]
- 11/02 • made of fibres or threads, e.g. of textile
- 11/04 • made of rubber or flexible plastics
- 11/06 • • with homogeneous wall (F16L 11/11 takes precedence) [2]
- 11/08 • • with reinforcements embedded in the wall (F16L 11/11 takes precedence) [2]
- 11/10 • • with reinforcements not embedded in the wall (F16L 11/11 takes precedence) [2]
- 11/11 • • with corrugated wall [2]
- 11/112 • • • having reinforcements embedded in the wall [5]
- 11/115 • • • having reinforcements not embedded in the wall [5]
- 11/118 • • • having arrangements for particular purposes, e.g. electrically conducting [5]
- 11/12 • • with arrangements for particular purposes, e.g. specially profiled, with protecting layer, heated, electrically conducting (F16L 11/11 takes precedence) [2]
- 11/127 • • • electrically conducting [5]
- 11/133 • • • buoyant [5]
- 11/14 • made of rigid material, e.g. metal or hard plastics
- 11/15 • • corrugated (F16L 11/16 takes precedence) [5]
- 11/16 • • wound from profiled strips or bands
- 11/18 • • Articulated hoses, e.g. composed of a series of rings
- 11/20 • Double-walled hoses [5]
- 11/22 • Multi-channel hoses [5]
- 11/24 • wound from strips or bands (F16L 11/16 takes precedence) [5]
- 11/26 • made of sound-absorbing materials or with sound-absorbing structure [7]

### Pipe joints; Hose nipples [2]

- 13/00 Non-disconnectable pipe joints, e.g. soldered, adhesive, or caulked joints** (joints for rigid pipes of plastics F16L 47/00)
- 13/007 • specially adapted for joining pipes of dissimilar materials [5]
- 13/013 • • Accessories therefor [5]
- 13/02 • Welded joints
- 13/04 • • with arrangements preventing overstressing
- 13/06 • • • with tension-relief of the weld by means of detachable members, e.g. divided tensioning rings, bolts in flanges
- 13/08 • Soldered joints
- 13/10 • Adhesive or cemented joints
- 13/11 • • using materials which fill the space between parts of a joint before hardening [2]
- 13/12 • with a seal made of lead, caulked packing, or the like
- 13/14 • made by plastically deforming the material of the pipe, e.g. by flanging, rolling
- 13/16 • • the pipe joint consisting of overlapping extremities having mutually co-operating collars [5]
- 15/00 Screw-threaded joints** (casing joints used in deep-drilling E21B 17/08; joints sealed primarily by means other than engagement of screw-threads, see the relevant groups characterised by the sealing arrangements); **Forms of screw-threads for such joints**

- 15/02 • allowing substantial longitudinal adjustment by the use of a long screw-threaded part
- 15/04 • with additional sealings [2]
- 15/06 • characterised by the shape of the screw-thread [5]
- 15/08 • with supplementary elements (F16L 15/04 takes precedence) [5]
- 17/00 Joints with packing adapted to sealing by fluid pressure** (compensating devices F16L 51/00)
- 17/02 • with sealing rings arranged between outer surface of pipe and inner surface of sleeve or socket
- 17/025 • • the sealing rings having radially directed ribs [5]
- 17/03 • • having annular axial lips [2]
- 17/035 • • • the sealing rings having two lips parallel to each other [5]
- 17/04 • • with longitudinally split or divided sleeve
- 17/06 • with sealing rings arranged between the end surfaces of the pipes or flanges or arranged in recesses in the pipe ends or flanges
- 17/067 • • Plastics sealing rings [6]
- 17/073 • • • the sealing rings having two lips parallel to each other [6]
- 17/08 • • Metal sealing rings [5]
- 17/10 • the packing being sealed by the pressure of a fluid other than the fluid in or surrounding the pipe (expansion-compensation arrangements for pipe-lines F16L 51/00) [5]
- 19/00 Joints in which sealing surfaces are pressed together by means of a member, e.g. a swivel nut, screwed on, or into, one of the joint parts** (F16L 17/00 takes precedence; if using bolts or equivalent connecting means F16L 23/00; connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics F16L 47/00)
- 19/02 • Pipe ends provided with collars or flanges, integral with the pipe or not, pressed together by a screwed member
- 19/025 • • the pipe ends having integral collars or flanges [5]
- 19/028 • • • the collars or flanges being obtained by deformation of the pipe wall [6]
- 19/03 • • with flexible sealing rings between the sealing surfaces [2]
- 19/04 • using additional rigid rings, sealing directly on at least one pipe end, which is flared either before or during the making of the connection
- 19/05 • • with a rigid pressure ring between the screwed member and the exterior of the flared pipe end [5]
- 19/06 • in which radial clamping is obtained by wedging action on non-deformed pipe ends
- 19/065 • • the wedging action being effected by means of a ring [5]
- 19/07 • • adapted for use in socket or sleeve connections [2]
- 19/075 • • specially adapted for spigot-and-socket joints [5]
- 19/08 • with metal rings which bite into the wall of the pipe
- 19/10 • • the profile of the ring being altered [5]
- 19/12 • • • with additional sealing means [5]
- 19/14 • • • the rings being integral with one of the connecting parts [6]
- 21/00 Joints with sleeve or socket** (F16L 13/00, F16L 17/00, F16L 19/00 take precedence; connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics F16L 47/00; specially adapted for pipes of brittle material F16L 49/00)

- 21/02 • with elastic sealing rings between pipe and sleeve or between pipe and socket, e.g. with rolling or other prefabricated profiled rings (F16L 21/06, F16L 21/08 take precedence; if adjustability is essential F16L 27/00)
- 21/025 • • Rolling sealing rings [5]
- 21/03 • • placed in the socket before connection (F16L 21/025 takes precedence) [5]
- 21/035 • • placed around the spigot end before connection (F16L 21/025 takes precedence) [5]
- 21/04 • • in which sealing rings are compressed by axially-movable members
- 21/05 • • comprising a first ring being placed on a male part and a second ring in the sleeve or socket [6]
- 21/06 • with a divided sleeve or ring clamping around the pipe ends (flanged joints F16L 23/00; couplings of the quick-acting type F16L 37/00)
- 21/08 • with additional locking means (F16L 21/06 takes precedence; couplings of the quick-acting type F16L 37/00)
- 23/00 Flanged joints** (F16L 13/00, F16L 17/00, F16L 19/00 take precedence; adjustable joints F16L 27/00; for hoses F16L 33/00; couplings of the quick-acting type F16L 37/00; for double-walled or multi-channel pipes, or pipe assemblies F16L 39/00; connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics F16L 47/00; specially adapted for pipes of brittle material F16L 49/00)
- 23/02 • the flanges being connected by members tensioned axially (F16L 23/12 takes precedence) [2, 5]
- 23/024 • • characterised by how the flanges are joined to, or form an extension of, the pipes [5]
- 23/026 • • • by welding [6]
- 23/028 • • • the flanges being held against a shoulder [5]
- 23/032 • • characterised by the shape or composition of the flanges [5]
- 23/036 • • characterised by the tensioning members, e.g. specially adapted bolts or C-clamps [5]
- 23/04 • the flanges being connected by members tensioned in the radial plane (F16L 23/12 takes precedence) [2, 5]
- 23/06 • • connected by toggle-action levers (quick acting couplings tightened by toggle-action levers F16L 37/20) [5]
- 23/08 • • connection by tangentially arranged pin and nut [5]
- 23/10 • • • with a pivoting or swinging pin [5]
- 23/12 • specially adapted for particular pipes [5]
- 23/14 • • for rectangular pipes [5]
- 23/16 • characterised by the sealing means [5]
- 23/18 • • the sealing means being rings [6]
- 23/20 • • • made exclusively of metal [6]
- 23/22 • • • made exclusively of a material other than metal [6]
- 23/24 • • specially adapted for unequal expansion of the parts of the joint [6]
- 25/00 Construction or details of pipe joints not provided for in, or of interest apart from, groups F16L 13/00-F16L 23/00** (adjustable or allowing movement F16L 27/00; with fluid cut-off means F16L 29/00; quick-acting F16L 37/00; for double-walled or multi-channel pipes F16L 39/00; connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics F16L 47/00; specially adapted for pipes of brittle material F16L 49/00)
- 25/01 • specially adapted for realising electrical conduction between the two pipe ends of the joint or between parts thereof (electrically-conductive connections between or with tubular conductors H01R 4/60) [7]
- 25/02 • specially adapted for electrically insulating the two pipe ends of the joint from each other [2]
- 25/03 • • in non-disconnectable pipe joints [7]
- 25/04 • comprising a collar or ring having a threaded pin rigid with the pipe-encircling member [5]
- 25/06 • comprising radial locking means [5]
- 25/08 • • in the form of screws, nails or the like [6]
- 25/10 • Sleeveless joints between two pipes, one being introduced into the other [7]
- 25/12 • Joints for pipes being spaced apart axially [7]
- 25/14 • Joints for pipes of different diameters or cross-section [7]
- 27/00 Adjustable joints; Joints allowing movement** (of the quick-acting type F16L 37/50; for double-walled or multi-channel pipes or pipe assemblies F16L 39/04; swivel joints in hose lines used for flushing boreholes E21B 21/02) [5]
- 27/02 • Universal joints, i.e. with mechanical connection allowing angular movement or adjustment of the axes of the parts in any direction
- 27/04 • • with partly-spherical engaging surfaces
- 27/047 • • • held in place by a screwed member having an internal spherical surface [5]
- 27/053 • • • held in place by bolts passing through flanges [5]
- 27/06 • • • with special sealing means between the engaging surfaces
- 27/067 • • • • the sealing means being actuated by the medium pressure [5]
- 27/073 • • • • one of the cooperating surfaces forming the sealing means [5]
- 27/08 • allowing adjustment or movement only about the axis of one pipe
- 27/087 • • Joints with radial fluid passages [6]
- 27/093 • • • of the "banjo" type, i.e. pivoting right-angle couplings [6]
- 27/10 • comprising a flexible connection only
- 27/103 • • in which a flexible element, e.g. a rubber-metal laminate, which undergoes constraints consisting of shear and flexure, is sandwiched between partly curved surfaces [6]
- 27/107 • • the ends of the pipe being interconnected by a flexible sleeve [5]
- 27/108 • • • the sleeve having the form of a bellows with only one corrugation [6]
- 27/11 • • • the sleeve having the form of a bellows with multiple corrugations [6]
- 27/111 • • • • the bellows being reinforced [6]
- 27/113 • • the ends of the pipe being interconnected by a rigid sleeve [5]
- 27/12 • allowing substantial longitudinal adjustment or movement (by use of screw-thread F16L 15/02)
- 29/00 Joints with fluid cut-off means** (quick-acting joints with cut-off means F16L 37/28)
- 29/02 • with a cut-off device in one of the two pipe ends, the cut-off device being automatically opened when the coupling is applied [5]
- 29/04 • with a cut-off device in each of the two pipe ends, the cut-off devices being automatically opened when the coupling is applied [5]

- 31/00 Arrangements for connecting hoses to one another or to flexible sleeves** (F16L 33/00 takes precedence)
- 31/02 • for branching hoses [6]
- 33/00 Arrangements for connecting hoses to rigid members** (hand tools for inserting fittings into hoses B25B 27/10); **Rigid hose-connectors, i.e. single members engaging both hoses** (connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics F16L 47/00)
- Note(s)**  
Groups F16L 33/01 and F16L 33/26 take precedence over other subgroups
- 33/01 • specially adapted for hoses having a multi-layer wall [2]
- 33/02 • Hose-clips
- 33/025 • • tightened by deforming radially extending loops or folds [7]
- 33/03 • • Self-locking elastic clips [7]
- 33/035 • • fixed by means of teeth or hooks [7]
- 33/04 • • tightened by tangentially-arranged threaded pin and nut
- 33/06 • • • in which the threaded pin is rigid with the hose-encircling member
- 33/08 • • in which a worm coacts with a part of the hose-encircling member that is toothed like a worm-wheel
- 33/10 • • with a substantially-radial tightening member
- 33/12 • • with a pivoted or swinging tightening or securing member, e.g. toggle lever
- 33/14 • • with a taping-bolt, i.e. winding up the end of the hose-encircling member
- 33/16 • with sealing or securing means using fluid pressure
- 33/18 • characterised by the use of additional sealing means
- 33/20 • Undivided rings, sleeves, or like members contracted on the hose or expanded inside the hose by means of tools; Arrangements using such members
- 33/207 • • only a sleeve being contracted on the hose [5]
- 33/213 • • only a sleeve being expanded inside the hose [5]
- 33/22 • with means not mentioned in the preceding groups for gripping the hose between inner and outer parts
- 33/23 • • the outer parts being segmented, the segments being pressed against the hose by tangentially arranged members [2]
- 33/24 • with parts screwed directly on or into the hose (F16L 33/22 takes precedence)
- 33/26 • specially adapted for hoses made of metal
- 33/28 • for hoses with one end terminating in a radial flange or collar [5]
- 33/30 • comprising parts inside the hoses only (F16L 33/24 takes precedence) [7]
- 33/32 • comprising parts outside the hoses only (F16L 33/24 takes precedence) [7]
- 33/34 • with bonding obtained by vulcanisation, gluing, melting, or the like [7]
- 35/00 Special arrangements used in connection with end fittings of hoses, e.g. safety or protecting devices**
- 37/00 Couplings of the quick-acting type** (radially-binding sleeves F16L 17/04, F16L 21/06; connecting hoses to rigid members F16L 33/00; connections made automatically when vehicles are brought together B60D, B61G; specially adapted for lubricating devices F16N 21/00)
- 37/02 • in which the connection is maintained only by friction of the parts being joined (F16L 37/22 takes precedence)
- 37/04 • • with an elastic outer part pressing against an inner part by reason of its elasticity (with locking members F16L 37/08)
- 37/05 • • • tightened by the pressure of a mechanical organ [5]
- 37/06 • • • tightened by fluid pressure
- 37/08 • in which the connection between abutting or axially-overlapping ends is maintained by locking members (F16L 37/22-F16L 37/26 take precedence)
- 37/084 • • combined with automatic locking [5]
- 37/086 • • • by means of latching members pushed radially by spring-like elements [7]
- 37/088 • • • by means of a split elastic ring [5]
- 37/091 • • • by means of a ring provided with teeth or fingers [7]
- 37/092 • • • by means of elements wedged between the pipe and the frusto-conical surface of the body of the connector [5]
- 37/096 • • • by means of hooks hinged about an axis [5]
- 37/098 • • • by means of flexible hooks [7]
- 37/10 • • using a rotary external sleeve or ring on one part
- 37/107 • • • Bayonet-type couplings [7]
- 37/113 • • • the male part having lugs on its periphery penetrating into the corresponding slots provided in the female part [7]
- 37/12 • • using hooks, pawls, or other movable or insertable locking members (F16L 37/084 takes precedence) [5]
- 37/124 • • • using bolts, fixed to a flange, which are able to tilt in slots of another flange, and being maintained there by the tightening of nuts [7]
- 37/127 • • • using hooks hinged about an axis [5]
- 37/133 • • • using flexible hooks [5]
- 37/138 • • • using an axially movable sleeve [7]
- 37/14 • • • Joints secured by inserting between mating surfaces an element, e.g. a piece of wire, a pin, a chain
- 37/15 • • • • the element being a wedge [7]
- 37/16 • • • Joints tightened by the action of wedge-shaped hinged hooks
- 37/18 • • • Joints tightened by eccentrics or rotatable cams
- 37/20 • • • Joints tightened by toggle-action levers
- 37/22 • in which the connection is maintained by means of balls, rollers, or helical springs under radial pressure between the parts
- 37/23 • • by means of balls [5]
- 37/24 • in which the connection is made by inserting one member axially into the other and rotating it to a limited extent, e.g. with bayonet-action
- 37/244 • • the coupling being co-axial with the pipe [5]
- 37/248 • • • Bayonet-type couplings [5]
- 37/252 • • • the male part having lugs on its periphery penetrating into the corresponding slots provided in the female part [5]
- 37/256 • • the coupling not being coaxial with the pipe [5]
- 37/26 • in which the connection is made by transversely moving the parts together, with or without their subsequent rotation
- 37/28 • with fluid cut-off means
- 37/30 • • with fluid cut-off means in each of two pipe-end fittings [5]
- 37/32 • • • at least one of two lift valves being opened automatically when the coupling is applied [5]

- 37/33 • • • • the lift valves being of the ball type [7]
- 37/34 • • • • at least one of the lift valves being of the sleeve type, i.e. a sleeve being telescoped over an inner cylindrical wall [5]
- 37/35 • • • • at least one of the valves having an axial bore communicating with lateral apertures [7]
- 37/36 • • • with two lift valves being actuated to initiate the flow through the coupling after the two coupling parts are locked against withdrawal [5]
- 37/367 • • • with two gate valves or sliding valves [7]
- 37/373 • • • with two taps or cocks [7]
- 37/38 • • with fluid cut-off means in only one of two pipe-end fittings [5]
- 37/40 • • • with a lift valve being opened automatically when the coupling is applied [5]
- 37/407 • • • • the lift valve being of the ball type [7]
- 37/413 • • • • the lift valve being of the sleeve type, i.e. a sleeve being telescoped over an inner cylindrical wall [7]
- 37/42 • • • • the valve having an axial bore communicating with lateral apertures [5]
- 37/44 • • • with one lift valve being actuated to initiate the flow through the coupling after the two coupling parts are locked against withdrawal [5]
- 37/46 • • • with a gate valve or sliding valve [5]
- 37/47 • • • with a tap or cock [7]
- 37/48 • for fastening a pipe on the end of a tap [5]
- 37/50 • adjustable; allowing movement of the parts joined [5]
- 37/52 • • Universal joints, i.e. with a mechanical connection allowing angular movement or adjustment of the axes of the parts in any direction [5]
- 37/53 • • allowing adjustment or movement only about the axis of one pipe [7]
- 37/54 • • for pipes under pressure which are supported only on one side [5]
- 37/56 • for double-walled or multi-channel pipes [5]
- 37/58 • the extremities of the two halves of the joint being pressed against each other without being locked in position [5]
- 37/60 • with plug and fixed wall housing [7]
- 37/62 • pneumatically or hydraulically actuated [7]
- 39/00 Joints or fittings for double-walled or multi-channel pipes or pipe assemblies**
- 39/02 • for hoses
- 39/04 • allowing adjustment or movement
- 39/06 • of the multiline swivel type, e.g. comprising a plurality of axially mounted modules [7]
- 41/00 Branching pipes; Joining pipes to walls** (F16L 39/00 takes precedence; connections not designed for conveying fluid F16B 9/00; joints suitable for connecting together pipe ends, see the relevant groups)
- 41/02 • Branch units, e.g. made in one piece, welded, riveted
- 41/03 • • comprising junction pieces for four or more pipe members [5]
- 41/04 • Tapping pipe walls, i.e. making connections through the walls of pipes while they are carrying fluids; Fittings therefor (apparatus or operations relating to metal-working steps, see the relevant classes for metal-working)
- 41/06 • • making use of attaching means embracing the pipe
- 41/08 • Joining pipes to walls or pipes, the joined pipe axis being perpendicular to the plane of a wall or to the axis of another pipe (F16L 41/02 takes precedence) [2]
- 41/10 • • the extremity of the pipe being screwed into the wall [5]
- 41/12 • • using attaching means embracing the pipe [5]
- 41/14 • • by screwing an intermediate part against the inside or outside of the wall [5]
- 41/16 • • the branch pipe comprising fluid cut-off means [5]
- 41/18 • the branch pipe being movable [7]
- 43/00 Bends; Siphons** (with cleaning apertures F16L 45/00; siphons for water-closets E03D 11/18; siphons in general F04F 10/00)
- 43/02 • adapted to make use of special securing means
- 45/00 Pipe units with cleaning aperture and closure therefor**
- 47/00 Connecting arrangements or other fittings specially adapted to be made of plastics or to be used with pipes made of plastics** (packing, for joints, adapted to sealing by fluid pressure F16L 17/00)
- 47/02 • Welded joints; Adhesive joints
- 47/03 • • Welded joints with an electrical resistance incorporated in the joint [7]
- 47/04 • with a swivel nut or collar engaging the pipe [2]
- 47/06 • with sleeve or socket formed by or in the pipe end [2]
- 47/08 • • with sealing rings arranged between the outer surface of one pipe end and the inner surface of the sleeve or socket, the sealing rings being placed previously in the sleeve or socket [7]
- 47/10 • • • the sealing rings being maintained in place by additional means [7]
- 47/12 • • with additional locking means [7]
- 47/14 • Flanged joints [7]
- 47/16 • Screw-threaded joints [7]
- 47/18 • Adjustable joints; Joints allowing movement [7]
- 47/20 • based principally on specific properties of plastics [7]
- 47/22 • • using shrink-down material [7]
- 47/24 • • for joints between metal and plastics pipes [7]
- 47/26 • for branching pipes; for joining pipes to walls; Adaptors therefor [7]
- 47/28 • • Joining pipes to walls or to other pipes, the axis of the joined pipe being perpendicular to the wall or to the axis of the other pipe [7]
- 47/30 • • • using attaching means embracing the pipe [7]
- 47/32 • • Branch units, e.g. made in one piece, welded, riveted [7]
- 47/34 • • Tapping pipes, i.e. making connections through walls of pipes while carrying fluids; Fittings therefor [7]
- 49/00 Connecting arrangements, e.g. joints, specially adapted for pipes of brittle material, e.g. glass, earthenware**
- 49/02 • Joints with a sleeve or socket [5]
- 49/04 • Flanged joints [5]
- 49/06 • Joints in which sealing surfaces are pressed together by means of a member, e.g. swivel nut, screwed on, or into, one of the joint parts [7]
- 49/08 • Adjustable joints; Joints allowing movement [7]
- 51/00 Expansion-compensation arrangements for pipe-lines** (telescopic pipes F16L 27/12)

**F16L**

- 51/02 • making use of a bellows or an expansible folded or corrugated tube
  - 51/03 • • comprising two or more bellows [5]
  - 51/04 • making use of bends, e.g. lyre-shaped
  - 53/00 Heating or cooling pipes or pipe systems** (preventing freezing of pipes, thawing frozen pipes E03B 7/12, E03B 7/14; pipe-line systems, pipe-lines F17D)
  - 55/00 Devices or appurtenances for use in, or in connection with, pipes or pipe systems** (F16L 1/00-F16L 53/00, F16L 57/00, F16L 59/00 take precedence; repairing or joining pipes on or under water F16L 1/26; nozzles B05B; cleaning of pipes B08B 9/02, e.g. removal of blockages B08B 9/027; devices for preventing bursting of water pipes by freezing E03B 7/10; for domestic plumbing installations E03C 1/00; arrangements for sealing leaky tubes or conduits of heat-exchangers F28F 11/00)
  - 55/02 • Energy absorbers; Noise absorbers (in valves F16K 47/00)
  - 55/027 • • Throttle passages (influencing fluid flow F15D 1/00; control of fluid flow G05D 7/00) [5]
  - 55/033 • • Noise absorbers (F16L 55/027 takes precedence) [5]
  - 55/035 • • • in the form of specially adapted hangers or supports [7]
  - 55/04 • Devices damping pulsations or vibrations in fluids
  - 55/045 • • specially adapted to prevent or minimise the effects of water hammer [5]
  - 55/05 • • • Buffers therefor (accumulators F15B 1/04) [5]
  - 55/052 • • • • Pneumatic reservoirs [7]
  - 55/053 • • • • • the gas in the reservoir being separated from the fluid in the pipe [7]
  - 55/054 • • • • • the reservoir being placed in or around the pipe from which it is separated by a sleeve-shaped membrane [7]
  - 55/055 • • • Valves therefor [5]
  - 55/07 • Arrangement or mounting of devices, e.g. valves, for venting or aerating or draining (arrangement of draining devices in water-supply systems E03B 7/08; apparatus for draining F16K, F16T; venting or aerating devices *per se* F16K 24/00) [2]
  - 55/09 • Air-conditioning, e.g. de-watering, in pneumatic systems (in general F24)
  - 55/10 • Means for stopping flow in pipes or hoses (F16L 29/00, F16L 37/28 take precedence; for covering leaks F16L 55/16; valves F16K) [1, 7]
  - 55/103 • • by temporarily freezing liquid sections in the pipe [7]
  - 55/105 • • Closing devices introduced radially into the pipe or hose [5]
  - 55/11 • • Plugs [5]
  - 55/115 • • Caps [5]
  - 55/12 • • by introducing into the pipe a member expandable in situ (inflatable cut-off valves F16K 7/10)
  - 55/124 • • • introduced radially into the pipe or hose [5]
  - 55/128 • • • introduced axially into the pipe or hose [5]
  - 55/13 • • • • the closure device being a plug fixed by plastic deformation [7]
  - 55/132 • • • • the closure device being a plug fixed by radially deforming the packing [5]
  - 55/134 • • • • • by means of an inflatable packing [7]
  - 55/136 • • • • the closure device being a plug fixed by radially expanding or deforming a split ring, hooks or the like [5]
  - 55/16 • Devices for covering leaks in pipes or hoses, e.g. hose-menders [1, 7]
  - 55/162 • • from inside the pipe (specially adapted for bends, branch units, branching pipes, or the like F16L 55/179) [5, 7]
  - 55/163 • • • a ring, a band or a sleeve being pressed against the inner surface of the pipe [7]
  - 55/164 • • • a sealing fluid being introduced in the pipe (F16L 55/1645 takes precedence) [7]
  - 55/1645 • • • a sealing material being introduced inside the pipe by means of a tool moving in the pipe [7]
  - 55/165 • • • a pipe being inserted in the damaged section [5, 7]
  - 55/168 • • from outside the pipe (specially adapted for bends, branch units, branching pipes, or the like F16L 55/179) [5, 7]
  - 55/17 • • • by means of rings, bands or sleeves pressed against the outside surface of the pipe or hose (hose-clips for connecting hoses to rigid members F16L 33/02) [5, 7]
  - 55/172 • • • • the ring, band or sleeve being tightened by a tangentially arranged threaded pin and a nut [5, 7]
  - 55/175 • • • by using materials which fill a space around the pipe before hardening [5, 7]
  - 55/178 • • • by clamping an outer gasket against a joint with sleeve or socket [5, 7]
  - 55/179 • • specially adapted for bends, branch units, branching pipes or the like [7]
  - 55/18 • Appliances for use in repairing pipes (F16L 55/10 takes precedence)
  - 55/24 • Preventing accumulation of dirt or other matter in pipes, e.g. by traps, by strainers
  - 55/26 • Pigs or moles, i.e. devices movable in a pipe or conduit with or without self-contained propulsion means (tunnel railway systems B61B 13/10; conveying articles through pipes or tubes, e.g. tube mail systems, B65G 51/00) [5]
- Note(s)**
1. Pigs or moles specially adapted for particular applications are classified in the relevant places for the applications, e.g.
    - stopping flow from or in pipes or hoses F16L 55/12;
    - repairing pipes F16L 55/18;
    - applying liquids or other fluent materials to the inside of tubes B05C 7/08;
    - cleaning pipes or tubes or systems of pipes or tubes B08B 9/02;
    - welding or cutting B23K 37/02;
    - earth drilling E21B;
    - cleaning chimneys F23J 3/02;
    - cleaning internal or external surfaces of heat-exchange or heat-transfer conduits F28G;
    - measuring, testing G01;
    - inspection of vessels in nuclear reactors G21C 17/003;
    - inspection or maintenance of pipe-lines or tubes in nuclear installations G21C 17/017;
    - installing electric, or combined optical and electric, cables or lines H02G.
  2. In this group, it is desirable to add the indexing codes of group F16L 101/00.
- 55/28 • • Constructional aspects [6]
  - 55/30 • • • of the propulsion means, e.g. towed by cables [6]
  - 55/32 • • • • being self-contained [6]

- 55/34 • • • • the pig or mole being moved step by step [6]
- 55/36 • • • • jet driven [6]
- 55/38 • • • • driven by fluid pressure [6]
- 55/40 • • • of the body [6]
- 55/42 • • • • gelled or degradable [6]
- 55/44 • • • • expandable [6]
- 55/46 • • Launching or retrieval of pigs or moles [6]
- 55/48 • • Indicating the position of the pig or mole in the pipe or conduit [6]
- 57/00 Protection of pipes or objects of similar shape against external or internal damage or wear** (supporting of pipes inside other pipes or sleeves F16L 7/00; used in connection with end fittings of hoses F16L 35/00; protection of pipes or pipe fittings against corrosion or incrustation F16L 58/00; protection thereof during transport B65D, e.g. B65D 59/00)
- 57/02 • against cracking or buckling [7]
- 57/04 • against fire or other external sources of extreme heat [7]
- 57/06 • against wear (F16L 57/04 takes precedence) [7]
- 58/00 Protection of pipes or pipe fittings against corrosion or incrustation** (supporting of pipes inside other pipes or sleeves F16L 7/00; compound tubes F16L 9/14; cleaning pipes or tubes B08B 9/02)
- 58/02 • by means of internal or external coatings (coatings for thermal insulation F16L 59/00; methods or machines for applying coatings, see the relevant places, e.g. B28B 21/94) [2]
- 58/04 • • Coatings characterised by the materials used (F16L 58/16 takes precedence; compositions, see the relevant classes, e.g. C04B) [2]
- 58/06 • • • by cement, concrete, or the like [2]
- 58/08 • • • by metal [2]
- 58/10 • • • by rubber or plastics [2]
- 58/12 • • • by tar or bitumen [2]
- 58/14 • • • by ceramic or vitreous materials [2]
- 58/16 • • the coating being in the form of a bandage (apparatus for covering cores by winding B65H 81/00) [2]
- 58/18 • specially adapted for pipe fittings [2]
- 59/00 Thermal insulation in general** (heat, sound insulation in buildings E04B; heat insulation of steam engines F01B 31/08; heat insulation in rotary piston machines or engines F01C 21/06; heat insulation of pumps F04C 29/04; thermal insulation of pressure vessels F17C 1/12; vessels not under pressure, with provision for insulation F17C 3/02)
- 59/02 • Shape or form of insulating materials, with or without coverings integral with the insulating materials (chemical aspects, see the relevant classes)
- 59/04 • Arrangements using dry fillers, e.g. using slag wool
- 59/05 • • in prefabricated shells or covers [2]
- 59/06 • Arrangements using an air layer or vacuum
- 59/065 • • using vacuum (F16L 59/075 takes precedence) [7]
- 59/07 • • the air layer being enclosed by one or more layers of insulation [7]
- 59/075 • • the air layer or the vacuum being delimited by longitudinal channels distributed around the circumference of a tube [7]
- 59/08 • Means for preventing radiation, e.g. with metal foil
- 59/10 • Bandages or covers for the protection of the insulation, e.g. against the influence of the environment or against mechanical damage (integral with insulating materials F16L 59/02)
- 59/11 • • Rigid covers for elbows [7]
- 59/12 • Arrangements for supporting insulation from the wall or body insulated, e.g. by means of spacers between pipe and heat-insulating material; Arrangements specially adapted for supporting insulated bodies
- 59/125 • • Helical spacers [7]
- 59/13 • • Resilient supports [7]
- 59/135 • • Hangers or supports specially adapted for insulated pipes [7]
- 59/14 • Arrangements for the insulation of pipes or pipe systems (F16L 59/02-F16L 59/12 take precedence)
- 59/147 • • the insulation being located inwardly of the outer surface of the pipe [5]
- 59/15 • • for underground pipes [7]
- 59/153 • • for flexible pipes [5]
- 59/16 • • Arrangements specially adapted to local requirements at flanges, junctions, valves, or the like (means in or on valves for heating or cooling F16K 49/00)
- 59/18 • • • adapted for joints [5]
- 59/20 • • • • for non-disconnectable joints [5]
- 59/21 • • • adapted for expansion-compensation devices [7]
- 59/22 • • • adapted for bends [5]
- Indexing scheme associated with groups F16L 55/26-F16L 55/48, relating to uses and applications of pigs or moles. [6]**
- 101/00 Uses or applications of pigs or moles [6]**
- 
- 101/10 • Treating the inside of pipes [6]
- 101/12 • • Cleaning [6]
- 101/14 • • Drying [6]
- 101/16 • • Coating by application of fluent materials, e.g. painting [6]
- 101/18 • • Lining other than coating [6]
- 101/20 • Expelling gases or fluids [6]
- 101/30 • Inspecting, measuring or testing [6]
- 101/40 • Separating transported fluids [6]
- 101/50 • Pulling cables or the like [6]
- 101/60 • Stopping leaks [6]
- 101/70 • Drill-well operations [6]
- F16M FRAMES, CASINGS, OR BEDS, OF ENGINES OR OTHER MACHINES OR APPARATUS, NOT SPECIFIC TO AN ENGINE, MACHINE, OR APPARATUS PROVIDED FOR ELSEWHERE; STANDS OR SUPPORTS**

**Note(s)**

Attention is drawn to the following places:

B21B 31/02.....Metal-rolling stand frames

G01D 11/30.....Supports specially adapted for indicating or recording instruments.

F16M

Subclass index

FRAMES, CASINGS, OR BEDS

Displaceable.....3/00  
 For engines, machines, or apparatus.....1/00, 5/00  
 Foundations; details.....9/00, 7/00  
 STANDS OR SUPPORTS.....11/00, 13/00

<p><b>1/00</b> <b>Frames or casings of engines, machines, or apparatus; Frames serving as machinery beds [2]</b></p> <p>1/02 • for reciprocating engines or similar machines</p> <p>1/021 • • for housing crankshafts</p> <p>1/022 • • • of tunnel type, i.e. wherein the crankshaft can only be introduced axially (for engines or machines with star-shaped cylinder arrangement F16M 1/023)</p> <p>1/023 • • • specially adapted for engines or machines with star-shaped cylinder arrangement</p> <p>1/024 • • • facilitating assembly of power-transmitting parts of engines or machines, e.g. of connecting-rods</p> <p>1/025 • • • Assembling bearings in casings, e.g. having anchor bolts</p> <p>1/026 • • for housing movable engine or machine parts other than crankshafts, e.g. valve-gear housings</p> <p>1/04 • for rotary engines or similar machines</p> <p>1/08 • characterised by being built-up of sheet material or welded parts</p> <p><b>3/00</b> <b>Portable or wheeled frames or beds, e.g. for emergency power-supply aggregates, compressor sets (construction of vehicles in general B60-B62)</b></p> <p><b>5/00</b> <b>Engine beds, i.e. means for supporting engines or machines on foundations</b></p> <p><b>7/00</b> <b>Details of attaching or adjusting engine beds, frames, or supporting-legs on foundation or base; Attaching non-moving engine parts, e.g. cylinder blocks (elastic or equivalent mounting for absorbing vibrations F16F, especially F16F 15/04)</b></p> <p><b>9/00</b> <b>Special layout of foundations with respect to machinery to be supported (foundations for machinery E02D 27/44)</b></p> <p><b>11/00</b> <b>Stands or trestles as supports for apparatus or articles placed thereon (without heads F16M 13/00; easels or stands for blackboards or the like A47B 97/04; show-stands A47F 7/00; for workmen E04G 1/32; supporting, suspending for lighting devices F21V 21/00; special modifications for particular apparatus or articles, see the appropriate subclasses)</b></p> <p>11/02 • Heads</p>	<p>11/04 • • Means for attachment of apparatus; Means allowing adjustment of the apparatus relatively to the stand</p> <p>11/06 • • • allowing pivoting</p> <p>11/08 • • • • around a vertical axis</p> <p>11/10 • • • • around a horizontal axis</p> <p>11/12 • • • • in more than one direction</p> <p>11/14 • • • • with ball-joint (ball-jointed hinges F16C 11/06)</p> <p>11/16 • • Details concerning attachment of head-supporting legs, with or without actuation of locking members therefor</p> <p>11/18 • • with mechanism for moving the apparatus relatively to the stand</p> <p>11/20 • Undercarriages with or without wheels</p> <p>11/22 • • with approximately constant height, e.g. with constant length of column or of legs (F16M 11/42 takes precedence)</p> <p>11/24 • • changeable in height or length of legs, also for transport only (F16M 11/42 takes precedence)</p> <p>11/26 • • • by telescoping, with or without folding (details concerning the constructional features of telescoping parts only F16B 7/10)</p> <p>11/28 • • • • Undercarriages for supports with one single telescoping pillar</p> <p>11/30 • • • • • with co-moving side-struts</p> <p>11/32 • • • • Undercarriages for supports with three or more telescoping legs</p> <p>11/34 • • • • • Members limiting spreading of legs</p> <p>11/36 • • • • • Members preventing slipping of the feet</p> <p>11/38 • • • by folding</p> <p>11/40 • • • by means of coilable or bendable legs</p> <p>11/42 • with arrangement for propelling the support</p> <p><b>13/00</b> <b>Other supports for positioning apparatus or articles (heads thereof F16M 11/02; adapted to be stuck in the ground A45F 3/44); Means for steadying hand-held apparatus or articles</b></p> <p>13/02 • for supporting on, or attaching to, an object, e.g. tree, gate, window-frame, cycle</p> <p>13/04 • for supporting on, or holding steady relative to, a person, e.g. by chains</p> <p>13/06 • also serviceable for other purposes, e.g. to be used as spade, chair, ski-stick</p> <p>13/08 • • for use as a walking-cane</p>
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F16N LUBRICATING

Note(s)

Attention is drawn to the following places, which cover lubrication of specific apparatus or in particular processes:

A01D 69/12.....Harvesters  
 B21B 25/04.....Mandrels for metal tube rolling mills  
 B21B 27/06.....Rolls for metal rolling mills  
 B21D 37/18.....Tools for machines for working metal without removing material

B21J 3/00.....	Forging or pressing
B22D 11/07.....	Moulds for continuous casting of metals
B23C 5/28.....	Milling cutters
B23D 59/02, B23D 59/04.....	Metal saws
B23Q 11/10, B23Q 11/12.....	Machine tools
B25D 17/26.....	Portable power-driven percussive tools
B26B 19/40.....	Hair-clippers or dry-shavers
B27B 13/12.....	Band saw blades for wood or the like
B60R 17/00.....	Vehicles
B61B 12/08.....	Cable systems for railways
B61C 17/08.....	Railway locomotives
B61F 17/00.....	Axle-boxes of rail vehicles
B61K 3/00.....	Rail or wheel flanges of railways
B62D 55/092.....	Endless-track units for vehicles
B62J 31/00.....	Cycles
B65G 45/02.....	Conveyers
B66B 7/12.....	Ropes, cables or guides of elevators
D01H 7/20.....	Spindles of machines for spinning or twisting threads or fibres
D04B 35/28.....	Knitting machines
D05B 71/00.....	Sewing machines
D05C 13/04.....	Embroidering machines
E01B 7/26.....	Switches for railways
E05B 17/08.....	Locks
E05D 11/02.....	Hinges
E21B 10/22.....	Roller bits for earth drilling
F01C 21/04.....	Rotary-piston or oscillating-piston machines or engines
F01D 25/18.....	Non-positive-displacement machines
F01M.....	Machines or engines in general
F02C 7/06.....	Gas-turbine plants
F02F 1/20.....	Cylinders of combustion engines
F04B 39/02.....	Pumps for liquids
F04C 29/02.....	Rotary-piston or oscillating-piston pumps for liquids
F04D 29/04.....	Non-positive-displacement pumps
F16C 1/24.....	Flexible shafts
F16C 33/10.....	Sliding-contact bearings
F16C 33/66.....	Ball or roller bearings
F16F 1/24.....	Springs
F16H 57/04.....	Transmissions
F41A 29/04.....	Smallarms or ordnance
G04B 31/08.....	Clocks
H01R 39/56.....	Rotary current collectors, distributors or interrupters

### Subclass index

MODIFICATIONS OF APPARATUS OR MACHINES TO ENSURE LUBRICATION.....	1/00
LUBRICATION DEVICES	
Stationary; mobile; manual.....	7/00, 11/00, 9/00, 3/00, 5/00
Lubricating-pumps.....	13/00
Details: reservoirs; conduits; check valves.....	19/00, 21/00, 23/00
EQUIPMENT FOR DISTRIBUTION, PROPORTIONING, SAFETY, CONTROL, CLEANING.....	23/00-33/00
HANDLING OF LUBRICANTS, STORAGE.....	33/00-39/00
SPECIAL LUBRICATION.....	15/00, 17/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....	99/00

### Lubrication devices or arrangements for oil or grease

#### 1/00 Constructional modifications of parts of machines or apparatus for the purpose of lubrication

#### 3/00 Devices for supplying lubricant by manual action

- |      |                                   |
|------|-----------------------------------|
| 3/02 | • delivering oil                  |
| 3/04 | • • Oil cans; Oil syringes        |
| 3/06 | • • • delivering on squeezing     |
| 3/08 | • • • incorporating a piston-pump |
| 3/10 | • delivering grease               |
| 3/12 | • • Grease guns                   |

#### 5/00 Apparatus with hand-positioned nozzle supplied with lubricant under pressure (F16N 3/00 takes precedence)

- |      |   |
|------|---|
| 5/02 | • Nozzles or nozzle-valve arrangements therefor, e.g. high-pressure grease guns |
|------|---|

#### 7/00 Arrangements for supplying oil or unspecified lubricant from a stationary reservoir or the equivalent in or on the machine or member to be lubricated

- |      |  |
|------|--|
| 7/02 | • with gravity feed or drip lubrication            |
| 7/04 | • • with oil flow promoted by vibration            |
| 7/06 | • • Arrangements in which the droplets are visible |

## F16N

- 7/08 • • controlled by means of the temperature of the member to be lubricated
  - 7/10 • • incorporating manually-operated regulating means, e.g. spindles
  - 7/12 • with feed by capillary action, e.g. by wicks
  - 7/14 • the lubricant being conveyed from the reservoir by mechanical means (by pumping devices F16N 7/36, F16N 7/38)
  - 7/16 • • the oil being carried up by a lifting device
  - 7/18 • • • with one or more feed members fixed on a shaft
  - 7/20 • • • with one or more members moving around the shaft to be lubricated
  - 7/22 • • • shaped as rings
  - 7/24 • • • with discs, rollers, belts, or the like contacting the shaft to be lubricated
  - 7/26 • • Splash lubrication
  - 7/28 • • Dip lubrication
  - 7/30 • the oil being fed or carried along by another fluid
  - 7/32 • • Mist lubrication
  - 7/34 • • • Atomising devices for oil
  - 7/36 • with feed by pumping action of the member to be lubricated or of a shaft of the machine; Centrifugal lubrication
  - 7/38 • with a separate pump; Central lubrication systems
  - 7/40 • • in a closed circulation system
- 9/00 Arrangements for supplying oil or unspecified lubricant from a moving reservoir or the equivalent (also usable with a stationary reservoir F16N 7/00)**
- 9/02 • with reservoir on or in a rotary member
  - 9/04 • with reservoir on or in a reciprocating, rocking, or swinging member
- 11/00 Arrangements for supplying grease from a stationary reservoir or the equivalent in or on the machine or member to be lubricated; Grease cups**
- 11/02 • Hand-actuated grease cups, e.g. Stauffer cups
  - 11/04 • Spring-loaded devices
  - 11/06 • Weight-loaded devices
  - 11/08 • with mechanical drive, other than directly by springs or weights (lubricating-pumps F16N 13/00)
  - 11/10 • by pressure of another fluid
  - 11/12 • by centrifugal action

---

**13/00 Lubricating-pumps (oil cans with pump F16N 3/08)**

- 13/02 • with reciprocating piston (pumps with distributing equipment F16N 13/22)
- 13/04 • • Adjustable reciprocating pumps
- 13/06 • • Actuation of lubricating-pumps
- 13/08 • • • by hand
- 13/10 • • • with mechanical drive (F16N 13/18 takes precedence)
- 13/12 • • • • with ratchet
- 13/14 • • • • with cam or wobble-plate on shaft parallel to the pump cylinder or cylinders
- 13/16 • • • with fluid drive
- 13/18 • • • relative movement of pump parts being produced by inertia of one of the parts or of a driving member
- 13/20 • Rotary pumps (with distributing equipment F16N 13/22)
- 13/22 • with distributing equipment

- 15/00 Lubrication with substances other than oil or grease; Lubrication characterised by the use of particular lubricants in particular apparatus or conditions (F16N 17/00 takes precedence; lubricating compositions, selection of particular substances as lubricants in general C10M; lubrication specially adapted to machines or apparatus provided for in a single other class, see the relevant class for the machine or apparatus)**

- 15/02 • with graphite or graphite-containing compositions

- 15/04 • with water

- 17/00 Lubrication of machines or apparatus working under extreme conditions (additives to lubricating oil or lubricating grease C10M)**

- 17/02 • at high temperature

- 17/04 • at low temperature

- 17/06 • in vacuum or under reduced pressure (of rotary anodes of X-ray tubes H01J 35/10)

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### Details of lubricators or lubrication systems

- 19/00 Lubricant containers for use in lubricators or lubrication systems**

- 21/00 Conduits; Junctions; Fittings for lubrication apertures**

- 21/02 • Lubricating nipples

- 21/04 • Nozzles for connection of lubricating equipment to nipples

- 21/06 • Covering members for nipples, conduits, or apertures

- 23/00 Special adaptations of check valves**

- 25/00 Distributing equipment (combined with oil pump F16N 13/22)**

- 25/02 • with reciprocating distributing slide valve

- 25/04 • with rotary distributing member

- 27/00 Proportioning devices**

- 27/02 • Gating equipment

- 29/00 Special means in lubricating arrangements or systems providing for the indication or detection of undesired conditions; Use of devices responsive to conditions in lubricating arrangements or systems (constructions of apparatus outside the lubricating arrangements or systems, see the relevant classes)**

- 29/02 • for influencing the supply of lubricant

- 29/04 • enabling a warning to be given; enabling moving parts to be stopped

- 31/00 Means for collecting, retaining, or draining-off lubricant in or on machines or apparatus**

- 31/02 • Oil catchers; Oil wipers (oil-scraping rings for pistons F16J 9/20)

- 
- 33/00 Mechanical arrangements for cleaning lubricating equipment; Special racks or the like for use in draining lubricant from machine parts**

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### Care of lubricants

- 35/00 Storage of lubricants in engine-rooms or the like**

37/00	<b>Equipment for transferring lubricant from one container to another</b>	39/04	• by heating
37/02	• for filling grease guns	39/06	• by filtration
39/00	<b>Arrangements for conditioning of lubricants in the lubricating system</b> (cleaning of lubricating oil, lubricating compositions C10M)	39/08	• by diluting, e.g. by addition of fuel
39/02	• by cooling		
<b>F16P</b>	<b>SAFETY DEVICES IN GENERAL</b>	<b>99/00</b>	<b>Subject matter not provided for in other groups of this subclass [2006.01]</b>

**Note(s)**

Attention is drawn to the following places:

A01D 75/18, A01D 75/20.....	Harvesters or mowers
A01F 21/00.....	Threshing machines or baling presses
B02C 23/04.....	Crushing or disintegrating machines
B21B 33/00.....	Rolling of metal
B21D 55/00.....	Working sheet metal or tubes, rods or profiles without essentially removing material
B23B 25/04.....	Turning-machines
B23Q 11/00.....	Machine tools
B24B 55/00.....	Grinding or polishing machines
B25D 17/10.....	Portable power-driven percussive tools
B25J 19/06.....	Manipulators
B26D 7/22.....	Cutting machines
B27G 19/00.....	Wood saws
B65B 57/00.....	Packaging machines or apparatus
B65G 43/00.....	Conveyers
B65H 26/00.....	Web-advancing mechanisms
B65H 63/00.....	Handling or winding of thin or filamentary material
D01G 31/00.....	Treatment of fibres
D01H 13/14.....	Spinning or twisting
D05B 83/00.....	Sewing machines
F21V 25/00.....	Lighting devices.

**Devices protecting or preventing injuries to people**

**1/00 Safety devices independent of the control or operation of any machine** (protective devices for the eyes or ears, worn on the body or carried in the hand, A61F 9/00, A61F 11/00)

- 1/02 • Fixed screens or hoods  
 1/04 • Screens or hoods rotating with rotary shafts  
 1/06 • specially designed for welding

**3/00 Safety devices acting in conjunction with the control or operation of a machine; Control arrangements requiring the simultaneous use of two or more parts of the body** (F16P 5/00 takes precedence)

- 3/02 • Screens or other safety members moving in synchronism with members which move to and fro  
 3/04 • • for machines with parts which approach one another during operation, e.g. for stamping presses  
 3/06 • • • in which body parts of the operator are removed from the danger zone on approach of the machine parts  
 3/08 • in connection with the locking of doors, covers, guards, or like members giving access to moving machine parts  
 3/10 • • in which the operation of locking the door or other member causes the machine to start

- 3/12 • with means, e.g. feelers, which in case of the presence of a body part of a person in or near the danger zone influence the control or operation of the machine (F16P 3/08 takes precedence)  
 3/14 • • the means being photocells or other devices sensitive without mechanical contact  
 3/16 • • with feeling members moved by the machine  
 3/18 • Control arrangements requiring the use of both hands  
 3/20 • • for electric control systems  
 3/22 • • for hydraulic or pneumatic control systems  
 3/24 • • for mechanical controls

**5/00 Emergency means for rendering ineffective a coupling conveying reciprocating movement if the motion of the driven part is prematurely resisted**

**7/00 Emergency devices preventing damage to a machine or apparatus** (F16P 1/00, F16P 3/00, F16P 5/00 take precedence; indicating means, see the appropriate classes)

- 7/02 • by causing the machine to stop on the occurrence of dangerous conditions therein (devices in bearings affected by abnormal conditions F16C)

**F16P**

**F16S CONSTRUCTIONAL ELEMENTS IN GENERAL; STRUCTURES BUILT-UP FROM SUCH ELEMENTS, IN GENERAL**

**Note(s)**

This subclass does not cover similar elements and structures, restricted to use in the building art, which are covered by subclass E04C.

- |   |   |
|---|---|
| <p><b>1/00</b> <b>Sheets, panels, or other members of similar proportions; Constructions comprising assemblies of such members</b> (built-up gratings F16S 3/00; layered products B32B)</p> <p><b>Note(s)</b></p> <p>In this group, the members may be generally flat or curved, but they may depart from such shape in detail over part or all of their area, e.g. they may be corrugated, ribbed, flanged; ribs, flanges, or the like may be separately formed.</p> <p>1/02 • designed for being secured together edge to edge, e.g. at an angle; Assemblies thereof</p> <p>1/04 • produced by deforming or otherwise working a flat sheet (honeycomb or other core members for layered products B32B 3/00, e.g. B32B 3/12, B32B 3/24, B32B 3/26)</p> <p>1/06 • • by deforming only</p> <p>1/08 • • by cutting or perforating, with or without deformation</p> <p>1/10 • Composite members, e.g. with ribs or flanges attached (F16S 1/02 takes precedence)</p> | <p>1/12 • of substantial thickness, e.g. with varying thickness, with channels</p> <p>1/14 • Assemblies of such members with members of forms covered by group F16S 3/00 or F16S 5/00 (such other members being for jointing only F16S 1/02)</p> <p><b>3/00</b> <b>Elongated members, e.g. profiled members; Assemblies thereof; Gratings or grilles</b> (gratings or grilles formed from a sheet or the like F16S 1/00, particularly F16S 1/08; frames for doors, windows or the like E06B 1/00, E06B 3/00)</p> <p>3/02 • composed of two or more elongated members secured together side by side</p> <p>3/04 • designed for being joined to similar members in various relative positions</p> <p>3/06 • Assemblies of elongated members (F16S 3/02, F16S 3/04 take precedence)</p> <p>3/08 • • forming frameworks, e.g. gratings</p> <p><b>5/00</b> <b>Other constructional members not restricted to an application fully provided for in a single class</b></p> |
|---|---|

**F16T STEAM TRAPS OR LIKE APPARATUS FOR DRAINING-OFF LIQUIDS FROM ENCLOSURES PREDOMINANTLY CONTAINING GASES OR VAPOURS**

- |  |   |
|--|---|
| <p><b>1/00</b> <b>Steam traps or like apparatus for draining-off liquids from enclosures predominantly containing gases or vapours, e.g. gas lines, steam lines, containers</b></p> <p>1/02 • with valves controlled thermally</p> <p>1/04 • • by expansion rods</p> <p>1/06 • • by expansion tubes</p> <p>1/08 • • by bimetallic strips or plates</p> <p>1/10 • • by thermally-expansive liquids</p> <p>1/12 • with valves controlled by excess or release of pressure</p> <p>1/14 • • involving a piston, diaphragm, or bellows, e.g. displaceable under pressure of incoming condensate</p> <p>1/16 • • involving a high-pressure chamber and a low-pressure chamber communicating with one another, i.e. thermodynamic steam chambers</p> <p>1/18 • • involving a vacuum chamber</p> | <p>1/20 • with valves controlled by floats</p> <p>1/22 • • of closed-hollow-body type</p> <p>1/24 • • • using levers</p> <p>1/26 • • of upright-open-bucket type</p> <p>1/28 • • • using levers</p> <p>1/30 • • of inverted-open-bucket type; of bell type</p> <p>1/32 • • of rocking or tilting type</p> <p>1/34 • without moving parts other than hand valves, e.g. labyrinth type</p> <p>1/36 • specially adapted for steam lines of low pressure</p> <p>1/38 • Component parts; Accessories</p> <p>1/40 • • Actuating mechanisms of ball valves</p> <p>1/42 • • Actuating mechanisms of slide valves</p> <p>1/45 • • Means for venting or aerating (separate devices therefor F16K 24/00) [2]</p> <p>1/48 • • Monitoring arrangements for inspecting, e.g. flow of steam and steam condensate</p> |
|--|---|

## F17 STORING OR DISTRIBUTING GASES OR LIQUIDS

**F17B GAS-HOLDERS OF VARIABLE CAPACITY** (self-acting gas cut-off devices A47J 27/62, G05D; flame traps A62C 4/00; gas mixers B01F, F16K 11/00, G05D 11/00; construction or assembling of bulk storage containers employing civil-engineering techniques E04H 7/00; gas compressors F04; valves F16K; damping pulsations in valves or pipes F16K, F16L; pipes F16L; stopping devices for gas mains F16L 55/10; vessels adapted for storing compressed, liquefied, or solidified gases F17C; gas distribution systems F17D 1/04; detecting leakage F17D 5/02, G01M; supervising or alarm devices F17D 5/02, G08B; control of combustion in burners F23N; gas flow or pressure regulators G05D)

- |   |   |
|---|---|
| <p><b>1/00 Gas-holders of variable capacity</b> (large containers in general B65D 88/00; storing fluids in natural or artificial cavities or chambers in the earth B65G 5/00)</p> <p>1/007 • with telescopically movable ring-shaped parts (F17B 1/10 takes precedence; sealing of rings F17B 1/04) [2]</p> <p>1/013 • with movables discs (F17B 1/10 takes precedence; sealing of discs F17B 1/04) [2]</p> <p>1/02 • Details</p> <p>1/04 • • Sealing devices for sliding parts (in general F16J 15/00)</p> <p>1/06 • • • using sealing liquids</p> | <p>1/08 • • • using resilient materials for packing, e.g. leather</p> <p>1/10 • • Guiding moving parts</p> <p>1/12 • • Gas admission or discharge arrangements</p> <p>1/14 • • Safety devices, e.g. prevention of excess pressure</p> <p>1/16 • of wet type</p> <p>1/18 • • bell-shaped</p> <p>1/20 • • telescopic</p> <p>1/22 • • • spirally-guided</p> <p>1/24 • of dry type</p> <p>1/26 • • with flexible walls, e.g. bellows (connection of valves to inflatable elastic bodies B60C 29/00)</p> |
|---|---|

**F17C VESSELS FOR CONTAINING OR STORING COMPRESSED, LIQUEFIED, OR SOLIDIFIED GASES; FIXED-CAPACITY GAS-HOLDERS; FILLING VESSELS WITH, OR DISCHARGING FROM VESSELS, COMPRESSED, LIQUEFIED, OR SOLIDIFIED GASES** (storing fluids in natural or artificial cavities or chambers in the earth B65G 5/00; construction or assembling of bulk storage containers employing civil-engineering techniques E04H 7/00; variable-capacity gas-holders F17B; liquefaction or refrigeration machines, plants, or systems F25)

### Subclass index

VESSELS UNDER PRESSURE; VESSELS NOT UNDER PRESSURE; DETAILS.....1/00, 3/00, 13/00  
 FILLING; DISCHARGING.....5/00, 6/00, 7/00, 9/00  
 USE OF GAS-SOLVENTS OR GAS-ABSORBENTS.....11/00

- |  |   |
|--|---|
| <p><b>1/00 Pressure vessels, e.g. gas cylinder, gas tank, replaceable cartridge</b> (pressurised apparatus for purposes other than storage, <u>see</u> the relevant subclasses such as A62C, B05B; associated with vehicles, <u>see</u> the appropriate subclass of classes B60-B64; pressure vessels in general F16J 12/00)</p> <p>1/02 • involving reinforcing arrangements [4]</p> <p>1/04 • • Protecting sheatings</p> <p>1/06 • • • built-up from wound-on bands or filamentary material, e.g. wires [4]</p> <p>1/08 • • Integral reinforcements, e.g. ribs</p> <p>1/10 • with provision for protection against corrosion, e.g. due to gaseous acid (inhibiting corrosion of metallic material or incrustation in general C23F) [4]</p> <p>1/12 • with provision for thermal insulation (thermal insulation in general F16L 59/00) [4]</p> <p>1/14 • constructed of aluminium; constructed of non-magnetic steel</p> <p>1/16 • constructed of plastics materials</p> <p><b>3/00 Vessels not under pressure</b></p> <p>3/02 • with provision for thermal insulation (thermal insulation in general F16L 59/00)</p> <p>3/04 • • by insulating layers (F17C 3/08 takes precedence)</p> <p>3/06 • • • on the inner surface, i.e. in contact with the stored fluid [4]</p> | <p>3/08 • • by vacuum spaces, e.g. Dewar flask (for household use A47J 41/02)</p> <p>3/10 • • by liquid-circulating or vapour-circulating jackets</p> <p>3/12 • with provision for protection against corrosion, e.g. due to gaseous acid (protection against corrosion in general C23F)</p> <p><b>5/00 Methods or apparatus for filling pressure vessels with liquefied, solidified, or compressed gases</b> (adding propellants to aerosol containers B65B 31/00)</p> <p><b>Note(s)</b><br/>       This group <u>covers</u>:</p> <ul style="list-style-type: none"> <li>• the filling of vessels for storage of compressed or liquefied gases;</li> <li>• the filling of pressurised apparatus insofar as it is not covered by a single other subclass, e.g. A62C, B05B.</li> </ul> <p>5/02 • for filling with liquefied gases</p> <p>5/04 • • requiring the use of refrigeration, e.g. filling with helium or hydrogen</p> <p>5/06 • for filling with compressed gases</p> <p><b>6/00 Methods or apparatus for filling vessels not under pressure with liquefied or solidified gases [3]</b></p> |
|--|---|

F17C

**7/00 Methods or apparatus for discharging liquefied, solidified, or compressed gases from pressure vessels, not covered by another subclass**

- 7/02 • Discharging liquefied gases
- 7/04 • • with change of state, e.g. vaporisation [3]

**9/00 Methods or apparatus for discharging liquefied or solidified gases from vessels not under pressure**

- 9/02 • with change of state, e.g. vaporisation
- 9/04 • • Recovery of thermal energy [3]

**11/00 Use of gas-solvents or gas-sorbents in vessels**

**13/00 Details of vessels or of the filling or discharging of vessels**

- 13/02 • Special adaptations of indicating, measuring, or monitoring equipment (measuring in general G01)
- 13/04 • Arrangement or mounting of valves (valves per se F16K)
- 13/06 • Closures, e.g. cap, breakable member (closures for containers in general B65D)
- 13/08 • Mounting arrangements for vessels
- 13/10 • Arrangements for preventing freezing
- 13/12 • Arrangements or mounting of devices for preventing or minimising the effect of explosion (flame traps A62C 4/00)

**F17D PIPE-LINE SYSTEMS; PIPE-LINES** (distributing water E03B; pumps or compressors F04; fluid dynamics F15D; valves or the like F16K; pipes, laying pipes, supports, joints, branches, repairing, work on the entire line, accessories F16L; steam traps or the like F16T; fluid-pressure electric cables H01B 9/06)

**Note(s)**

In this subclass, the following expression is used with the meaning indicated:

- "pipe-line systems" means systems described in flow sheets as well as arrangements of co-operating elements, the elements per se being covered by the relevant subclasses.

**1/00 Pipe-line systems** (conveying articles or materials through a pipe-line by means of a fluid carrier B65G 51/00, B65G 53/00; dispensing, delivering or transferring liquids B67D; apparatus or devices for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers, e.g. for retail sale purposes, B67D 7/00; conveying material which has been excavated by a dredger or soil shifter through a pipe-line E02F 7/10; sewer pipe-line systems E03F 3/00; thermal insulation of pipe-lines F16L 59/00; central heating systems F24D) [2]

- 1/02 • for gases or vapours
- 1/04 • • for distribution of gas
- 1/05 • • • Preventing freezing (by heating F16L 53/00)
- 1/06 • • for steam
- 1/065 • • Arrangements for producing propulsion of gases or vapours [2]
- 1/07 • • • by compression [2]
- 1/075 • • • by mere expansion from an initial pressure level, e.g. by arrangement of a flow-control valve [2]
- 1/08 • for liquids or viscous products (water-main or service pipe systems E03B 7/04; domestic hot-water supply systems F24D 17/00) [2]
- 1/12 • • Conveying liquids or viscous products by pressure of another fluid [2]
- 1/13 • • Conveying liquids or viscous products by gravity [2]
- 1/14 • • Conveying liquids or viscous products by pumping [2]
- 1/16 • • Facilitating the conveyance of liquids or effecting the conveyance of viscous products by modification of their viscosity [2]
- 1/17 • • • by mixing with another liquid [2]
- 1/18 • • • by heating [2]
- 1/20 • Arrangements or systems of devices for influencing or altering dynamic characteristics of the systems, e.g. for damping pulsations caused by opening or closing of valves (fluid dynamics F15D; damping pulsations in fluids in pipes in general F16L 55/04) [2]

**3/00 Arrangements for supervising or controlling working operations**

- 3/01 • for controlling, signalling, or supervising the conveyance of a product [2]
- 3/03 • for controlling, signalling, or supervising the conveyance of several different products following one another in the same conduit, e.g. for switching from one receiving tank to another [2]
- 3/05 • • the different products not being separated (separation of contaminants by distillation B01D 3/00) [2]
- 3/08 • • the different products being separated by "go-devils", e.g. spheres (cleaning devices moved along the inside of pipe-lines by a fluid B08B 9/053) [2]
- 3/10 • for taking out the product in the line (investigating or analysing materials by determining their chemical or physical properties G01N) [2]
- 3/12 • for injecting a composition into the line [2]
- 3/14 • for eliminating water (separation of liquids B01D, e.g. B01D 17/00; separation of gases or vapours B01D 53/00) [2]
- 3/16 • for eliminating particles in suspension (from liquids by sedimentation B01D 21/00; separation by filtration or otherwise B01D 24/00-B01D 51/00; centrifugal apparatus B04) [2]
- 3/18 • for measuring the quantity of conveyed product (measuring volume or volume flow, in general G01F) [2]

**5/00 Protection or supervision of installations**

- (arrangements for protecting foundations E02D 31/00; protecting pipes from damage or internal or external wear F16L 57/00, against corrosion or scale F16L 58/00; investigation of the fluid-tightness of structures G01M 3/00) [2]
- 5/02 • Preventing, monitoring, or locating loss [2]
  - 5/04 • • by means of a signalling fluid enclosed in a double wall [2]
  - 5/06 • • using electric or acoustic means [2]

5/08 • Protection of installations or persons from the effects

of high voltage induced in the pipe-line (emergency protective circuit arrangements H02H) [2]

**LIGHTING; HEATING****F21 LIGHTING****Note(s)**

Attention is drawn to Note III of Section H, and in particular that subclass H05B covers electrical aspects of the same technical subjects that are covered by class F21.

**F21H INCANDESCENT MANTLES; OTHER INCANDESCENT BODIES HEATED BY COMBUSTION** (arrangements thereof F21V 36/00; burners F23D)

- |   |  |
|---|--|
| <p><b>1/00 Incandescent mantles; Selection of imbibition liquids therefor</b></p> <p>1/02 • characterised by the material thereof</p> <p><b>3/00 Manufacturing incandescent mantles; Treatment prior to use, e.g. burning-off; Machines for manufacturing</b></p> | <p><b>5/00 Solid incandescent bodies</b> (incandescent mantles F21H 1/00)</p> <p><b>7/00 Other incandescent bodies [2009.01]</b></p> |
|---|--|

**F21K LIGHT SOURCES NOT OTHERWISE PROVIDED FOR**

- |  |  |
|--|--|
| <p><b>2/00 Light sources using luminescence</b> (luminescent materials C09K 11/00; selection of luminescent materials for light screens F21V 9/16; using excitation by radioactivity G21H 3/02, H01J 65/06, H01J 65/08; transforming the wavelength of the light of gas- or vapour-discharge lamps by luminescence H01J 61/42; electroluminescent light sources H05B 33/00) [2, 7]</p> <p>2/04 • using triboluminescence; using thermoluminescence</p> <p>2/06 • using chemiluminescence [3]</p> <p>2/08 • • activated by an electric field, i.e. electrochemiluminescence [3]</p> <p><b>5/00 Light sources using charges of combustible material, e.g. illuminating flash devices</b> (explosive or thermic compositions C06B; fireworks F42B 4/00; photographic flash units G03B 15/03) [3, 5]</p> | <p>5/04 • Plural charges, e.g. associated for sequential ignition (F21K 5/06, F21K 5/12 take precedence) [5]</p> <p>5/06 • Charge containment [5]</p> <p>5/08 • • Charge held in non-disrupting container, e.g. photo-flash bulb [5]</p> <p>5/10 • • • bearing a coating [5]</p> <p>5/12 • Charge ignition [5]</p> <p>5/14 • • percussive [5]</p> <p>5/16 • • electrical (circuit arrangements H05B 43/02) [5]</p> <p>5/18 • • • Electrically-ignited primers [5]</p> <p>5/20 • Charge feeding means [5]</p> <p>5/22 • Protective light shields [5]</p> <p><b>99/00 Subject matter not provided for in other groups of this subclass [2010.01]</b></p> |
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**F21L LIGHTING DEVICES OR SYSTEMS THEREOF, BEING PORTABLE OR SPECIALLY ADAPTED FOR TRANSPORTATION** (burners F23D; electric aspects or elements, see section H, e.g. electric light sources H01J, H01K, H05B) [1, 7]

**Note(s)**

1. This subclass covers devices or systems designed or specially adapted to be carried, e.g. by hand, or otherwise transported from place to place, e.g. on wheeled supports, in order to provide illumination as and where required.
2. This subclass does not cover devices or systems intended for fixed installation, e.g. vehicle lighting, or for use essentially at a permanent location, which are covered by subclass F21S.
3. Non-electric lighting devices are classified in groups F21L 17/00-F21L 26/00 only if a special adaptation related to the use of a non-electric light source is of interest.
4. In this subclass, it is desirable to add the indexing codes of subclasses F21W and F21Y.

**Subclass index**

## ELECTRIC DEVICES

Systems.....	2/00
with self-contained batteries or cells.....	4/00
with built-in generators.....	13/00

without self-contained power source.....	14/00
NON-ELECTRIC DEVICES	
Torches, flares; lanterns.....	17/00, 19/00
Pocket-lamps; miners' hand-lamps.....	21/00, 23/00
Other portable lighting devices or systems thereof.....	26/00
COMBINATIONS OF ELECTRIC AND NON-ELECTRIC DEVICES.....	27/00

<b>2/00</b>	<b>Systems of electric lighting devices</b> (systems employing both electric and non-electric light sources or exchangeable light sources F21L 27/00) [7]	<b>14/00</b>	<b>Electric lighting devices without a self-contained power source, e.g. for mains connection [7]</b>
		14/02	• capable of hand-held use, e.g. inspection lamps [7]
		14/04	• carried on wheeled supports [7]
<b>4/00</b>	<b>Electric lighting devices with self-contained electric batteries or cells [7]</b>	<b>17/00</b>	<b>Non-electric torches; Non-electric flares</b>
4/02	• characterised by provision of two or more light sources [7]	<b>19/00</b>	<b>Lanterns, e.g. hurricane lamps or candle lamps</b> (candle holders F21V 35/00)
4/04	• characterised by provision of a light source housing portion adjustably fixed to the remainder of the device [7]	<b>21/00</b>	<b>Non-electric pocket-lamps, e.g. lamps producing sparks</b>
4/06	• with light source coupled to the remainder of the device solely by cable [7]	<b>23/00</b>	<b>Non-electric hand-lamps for miners</b>
4/08	• characterised by means for <u>in situ</u> recharging of the batteries or cells [7]	<b>26/00</b>	<b>Non-electric portable lighting devices, or systems thereof, not provided for in groups F21L 17/00-F21L 23/00 [2006.01]</b>
<b>13/00</b>	<b>Electric lighting devices with built-in electric generators</b> (with solar cells F21L 4/00) [1, 7]	<b>27/00</b>	<b>Lighting devices or systems, employing combinations of electric and non-electric light sources; Replacing or exchanging electric light sources with non-electric light sources or <u>vice versa</u> in lighting devices or systems</b>
13/02	• with fluid drive		
13/04	• • actuated by hand		
13/06	• with mechanical drive, e.g. spring		
13/08	• • by reciprocating pusher actuated by hand		
<b>F21S</b>	<b>NON-PORTABLE LIGHTING DEVICES OR SYSTEMS THEREOF</b> (burners F23D; electric aspects or elements, <u>see</u> section H, e.g. electric light sources H01J, H01K, H05B) [1, 7]		

#### Note(s)

1. This subclass covers devices or systems intended for fixed installation, e.g. vehicle lighting, or for use at a permanent location, e.g. free-standing floor- or table-lamps.
2. This subclass does not cover devices or systems specially adapted for transportation, which are covered by subclass F21L.
3. Non-electric lighting devices or systems are classified in groups F21S 11/00-F21S 15/00 only if a special adaptation related to the use of a non-electric light source is of interest.
4. In this subclass, it is desirable to add the indexing codes of subclasses F21W and F21Y.

#### Subclass index

ELECTRIC DEVICES	
Systems.....	2/00
String or strip of light sources.....	4/00
Free-standing.....	6/00
Fixed installation.....	8/00
Built-in power supply.....	9/00
Producing varying lighting effects.....	10/00
NON-ELECTRIC DEVICES	
Using daylight.....	11/00
Light source: Point-like or of unspecified shape.....	13/00
Other devices.....	15/00
COMBINATIONS OF ELECTRIC AND NON-ELECTRIC DEVICES.....	19/00

<b>2/00</b>	<b>Systems of lighting devices, not provided for in main groups F21S 4/00-F21S 10/00 or F21S 19/00, e.g. of modular construction [7]</b>	<b>6/00</b>	<b>Lighting devices intended to be free-standing</b> (F21S 9/00, F21S 10/00 take precedence) [7]
<b>4/00</b>	<b>Lighting devices or systems using a string or strip of light sources [7]</b>	<b>8/00</b>	<b>Lighting devices intended for fixed installation</b> (F21S 9/00, F21S 10/00 take precedence; using a string or strip of light sources F21S 4/00) [7]

**F21S**

- 8/02 • of recess-mounted type, e.g. downlighters (F21S 8/10 takes precedence) [7]
- 8/04 • intended only for mounting on a ceiling or like overhead structure (F21S 8/02 takes precedence) [7]
- 8/06 • • by suspension [7]
- 8/08 • with a standard [7]
- 8/10 • specially adapted for vehicles [7]
- 8/12 • • providing a single shaped beam, e.g. asymmetric beam, e.g. for penetrating fog or for preventing glare [7]
- 9/00 Lighting devices with a built-in power supply; Systems employing lighting devices with a built-in power supply**
- 9/02 • the power supply being a battery or accumulator
- 9/03 • • rechargeable by exposure to light [7]
- 9/04 • the power supply being a generator
- 10/00 Lighting devices or systems producing a varying lighting effect [7]**
- 10/02 • changing colours (F21S 10/04 takes precedence) [7]
- 10/04 • simulating flames [7]
- 10/06 • flashing, e.g. with rotating reflector or light source [7]

- 11/00 Non-electric lighting devices or systems using daylight**
- 13/00 Non-electric lighting devices or systems employing a point-like light source (candle holders F21V 35/00); Non-electric lighting devices or systems employing a light source of unspecified shape**
- 13/02 • Devices intended to be fixed, e.g. ceiling lamp, wall lamp
- 13/04 • • with a pendant
- 13/06 • • • multi-branched, e.g. chandelier
- 13/08 • • with suspension from a stretched wire
- 13/10 • • with a standard, e.g. street lamp
- 13/12 • Devices intended to be free-standing, e.g. table lamp, floor lamp
- 13/14 • Lighting systems
- 15/00 Non-electric lighting devices or systems employing light sources not covered by main groups F21S 11/00, F21S 13/00 or F21S 19/00**
- 19/00 Lighting devices or systems employing combinations of electric and non-electric light sources; Replacing or exchanging electric light sources with non-electric light sources or vice versa**

**F21V FUNCTIONAL FEATURES OR DETAILS OF LIGHTING DEVICES OR SYSTEMS THEREOF; STRUCTURAL COMBINATIONS OF LIGHTING DEVICES WITH OTHER ARTICLES, NOT OTHERWISE PROVIDED FOR [1, 7]**

**Note(s) [2009.01]**

1. Groups F21V 1/00-F21V 14/00 cover details of those parts involved in light emission or distribution. Groups F21V 15/00-F21V 31/00 cover details of those parts not so involved.
2. Details of non-electric lighting devices or systems are classified in groups F21V 35/00-F21V 37/00 only if a special adaptation related to the use of a non-electric light source is of interest.
3. In this subclass, it is desirable to add the indexing codes of subclasses F21W and F21Y.

**Subclass index**

**DETAILS OF PARTS INVOLVED IN LIGHT EMISSION OR DISTRIBUTION**

Shades; globes; refractors; reflectors.....	1/00, 3/00, 5/00, 7/00
Light guides.....	8/00
Light filters.....	9/00
Other screens.....	11/00
Combinations of elements.....	13/00
Changing characteristics or distribution of the light.....	14/00

**DETAILS OF PARTS NOT INVOLVED IN LIGHT EMISSION OR DISTRIBUTION**

Fastening.....	17/00, 19/00
Arrangements for supporting or suspending.....	21/00
Arrangements of electric circuit elements.....	23/00
Cable stowing.....	27/00
Protection; safety; cooling; tightness.....	15/00, 25/00, 29/00, 31/00
Combinations with other articles.....	33/00
Candle holders.....	35/00
Arrangements of mantles or burners.....	36/00
Details of combustion lighting.....	37/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....	99/00

- |   |  |
|---|--|
| <b>1/00 Shades for light sources</b>        | 1/14 • Covers for frames; Frameless shades |
| 1/02 • Frames                               | 1/16 • • characterised by the material     |
| 1/04 • • rigid (F21V 1/08 takes precedence) | 1/18 • • • the material being paper        |
| 1/06 • • foldable or collapsible            | 1/20 • • • the material being glass        |
| 1/08 • • adjustable                         | 1/22 • • • the material being plastics     |
| 1/10 • Rotating shades                      | 1/24 • • • the material being metal        |
| 1/12 • Composite shades                     | 1/26 • Manufacturing shades                |

- 3/00 Globes; Bowls; Cover glasses** (with refracting properties F21V 5/00; with reflecting properties F21V 7/00)
- 3/02 • characterised by the shape
- 3/04 • characterised by the material; characterised by surface treatments or coatings
- 5/00 Refractors for light sources**
- 5/02 • of prismatic shape (F21V 5/04 takes precedence)
- 5/04 • of lens shape
- 5/06 • Hanging lustres for chandeliers
- 5/08 • producing an asymmetric light distribution [1, 7]
- 7/00 Reflectors for light sources**
- 7/04 • Optical design (F21V 7/22 takes precedence) [1, 7]
- 7/05 • • plane [1, 7]
- 7/06 • • with parabolic curvature [1, 7]
- 7/07 • • with hyperbolic curvature [1, 7]
- 7/08 • • with elliptical curvature [1, 7]
- 7/09 • • with a combination of different curvatures [1, 7]
- 7/10 • Construction (F21V 7/22 takes precedence) [1, 7]
- 7/16 • • with provision for adjusting the curvature [1, 7]
- 7/18 • • with provision for folding or collapsing [1, 7]
- 7/20 • • specially adapted for facilitating cooling, e.g. with fins [1, 7]
- 7/22 • characterised by the material; characterised by surface treatments or coatings
- 8/00 Use of light guides, e.g. fibre optic devices, in lighting devices or systems** (light guides *per se*, structural details of arrangements with other optical elements G02B 6/00) [4]
- 9/00 Light filters** (coloured shades F21V 1/00); **Selection of luminescent materials for light screens** (luminescent materials *per se* C09K 11/00; electroluminescent light sources *per se* H05B 33/00)
- 9/02 • for simulating daylight (F21V 9/04, F21V 9/06, F21V 9/16 take precedence)
- 9/04 • for filtering out infra-red radiation (using liquid-filled chambers F21V 9/12)
- 9/06 • for filtering out ultra-violet radiation (F21V 9/16 takes precedence)
- 9/08 • for producing coloured light, e.g. monochromatic; for reducing intensity of light (F21V 9/16 takes precedence)
- 9/10 • • with provision for variation of the colour or intensity (F21V 9/12 takes precedence)
- 9/12 • • with liquid-filled chambers
- 9/14 • for producing polarised light
- 9/16 • Selection of luminescent materials for light screens
- 11/00 Screens not covered by groups F21V 1/00, F21V 3/00, F21V 7/00 or F21V 9/00**
- 11/02 • using parallel laminae or strips, e.g. of Venetian-blind type (F21V 11/06 takes precedence)
- 11/04 • • adjustable
- 11/06 • using crossed laminae or strips; using lattices or honeycombs
- 11/08 • using diaphragms containing one or more apertures
- 11/10 • • of iris type
- 11/12 • • of slot type
- 11/14 • • with many small apertures
- 11/16 • using sheets without apertures, e.g. fixed (F21V 11/02, F21V 11/06 take precedence)
- 11/18 • • movable, e.g. flaps, slides
- 13/00 Producing particular characteristics or distribution of the light emitted by means of a combination of elements specified in two or more of main groups F21V 1/00-F21V 11/00** (changing the characteristics or distribution of the light emitted by adjustment of parts F21V 14/00) [1, 7]
- 13/02 • Combinations of only two kinds of elements
- 13/04 • • the elements being reflectors and refractors
- 13/06 • • • a reflector being rotatable
- 13/08 • • the elements being reflectors and filters
- 13/10 • • the elements being reflectors and screens
- 13/12 • Combinations of only three kinds of elements
- 13/14 • • the elements being reflectors, refractors, and filters
- 14/00 Changing the characteristics or distribution of the light emitted by adjustment of parts** (reflectors with provision for adjusting the curvature F21V 7/16; light filters with provision for variation of colour or intensity F21V 9/10; screens using iris-type diaphragms F21V 11/10; adjustable mountings for lighting devices F21V 21/14) [7]
- 14/02 • by movement of light sources [7]
- 14/04 • by movement of reflectors [7]
- 14/06 • by movement of refractors [7]
- 14/08 • by movement of screens [7]
- 15/00 Protecting lighting devices from damage** (cooling or heating arrangements F21V 29/00; gas-tight or water-tight arrangements F21V 31/00)
- 15/01 • Housings, e.g. material or assembling of housing parts (F21V 15/02 takes precedence) [7]
- 15/015 • • Devices for covering joints between adjacent lighting devices; End coverings [7]
- 15/02 • Cages
- 15/04 • Resilient mountings, e.g. shock-absorbers
- 15/06 • Thermal insulation [7]
- 17/00 Fastening of component parts of lighting devices, e.g. shades, globes, refractors, reflectors, filters, screens, grids or protective cages** (of light sources or light holders F21V 19/00; gas-tight or water-tight arrangements F21V 31/00)
- 17/02 • with provision for adjustment (F21V 17/04-F21V 17/08 take precedence; changing the characteristics or distribution of the light emitted by adjustment of parts F21V 14/00) [1, 7]
- 17/04 • onto or by the light source
- 17/06 • onto or by the lamp holder
- 17/08 • onto the supporting or suspending arrangements of the lighting device, e.g. power cords, standards [7]
- 17/10 • characterised by specific fastening means or way of fastening (F21V 17/02-F21V 17/08 take precedence) [7]
- 17/12 • • by screwing [7]
- 17/14 • • Bayonet-type fastening [7]
- 17/16 • • by deformation of parts of the lighting device; Snap action mounting [7]
- 17/18 • • Latch-type fastening, e.g. with rotary action [7]
- 17/20 • • by toggle-action levers [7]
- 19/00 Fastening of light sources or lamp holders** (fastening electric light source solely by the coupling device H01R 33/00)
- 19/02 • with provision for adjustment, e.g. for focusing (changing the characteristics or distribution of the light emitted by adjustment of parts F21V 14/00) [1, 7]
- 19/04 • with provision for changing light source, e.g. turret

## F21V

- 19/06 • Fastening incandescent mantles or other incandescent bodies to lamp parts; Suspension devices for incandescent mantles or other incandescent bodies [1, 7]
- 21/00 Supporting, suspending, or attaching arrangements for lighting devices** (F21V 17/00, F21V 19/00 take precedence); **Hand grips** [1, 7]
- 21/002 • making direct electrical contact, e.g. by piercing (F21V 21/35 takes precedence) [7]
- 21/005 • for several lighting devices in an end-to-end arrangement, i.e. light tracks [7]
- 21/008 • Suspending from a cable or suspension line [7]
- 21/02 • Wall, ceiling, or floor bases; Fixing pendants or arms to the bases (F21V 21/08 takes precedence; bases for movable standing lamps F21V 21/06)
- 21/03 • • Ceiling bases, e.g. ceiling roses (F21V 21/04 takes precedence) [7]
- 21/04 • • Recessed bases
- 21/06 • Bases for movable standing lamps; Fixing standards to the bases (F21V 21/08 takes precedence)
- 21/08 • Devices for easy attachment to a desired place
- 21/084 • • Head fittings (for medical purposes A61B 1/06) [7]
- 21/088 • • Clips; Clamps [7]
- 21/092 • • Suction devices [7]
- 21/096 • • Magnetic devices [7]
- 21/10 • Pendants, arms or standards; Fixing lighting devices to pendants, arms or standards (adjustable mounting F21V 21/14)
- 21/104 • • Pendants [7]
- 21/108 • • Arms [7]
- 21/112 • • Fixing lighting devices to pendants (F21V 21/002 takes precedence) [7]
- 21/116 • • Fixing lighting devices to arms or standards (F21V 21/002 takes precedence) [7]
- 21/12 • • capable of being elongated or shortened by the insertion or removal of intermediate pieces
- 21/13 • Spring-loaded poles fixed at both ends [7]
- 21/14 • Adjustable mountings
- 21/15 • • specially adapted for power operation, e.g. by remote control [7]
- 21/16 • • using wires or cords
- 21/18 • • • operated by springs
- 21/20 • • • operated by weights
- 21/22 • • telescopic
- 21/24 • • Lazy-tongs
- 21/26 • • Pivoted arms
- 21/28 • • • adjustable in more than one plane
- 21/29 • • • • employing universal joints
- 21/30 • • Pivoted housings or frames
- 21/32 • • Flexible tubes
- 21/34 • Supporting elements displaceable along a guiding element
- 21/35 • • with direct electrical contact between the supporting element and electric conductors running along the guiding element [7]
- 21/36 • Hoisting or lowering devices, e.g. for maintenance (F21V 21/14 takes precedence)
- 21/38 • • with a cable
- 21/40 • Hand grips [7]
- 23/00 Arrangement of electric circuit elements in or on lighting devices**
- 23/02 • the elements being transformers or impedances
- 23/04 • the elements being switches (safety devices F21V 25/00)
- 23/06 • the elements being coupling devices
- 25/00 Safety devices structurally associated with lighting devices** (gas-tight or water-tight arrangements F21V 31/00)
- 25/02 • coming into action when lighting device is disturbed, dismantled, or broken
- 25/04 • • breaking the electric circuit
- 25/06 • • feeding a quenching fluid to the light source
- 25/08 • • cutting the incandescent filament
- 25/10 • coming into action when lighting device is overloaded, e.g. thermal switch
- 25/12 • Flameproof or explosion-proof arrangements
- 27/00 Cable-stowing arrangements structurally associated with lighting devices, e.g. reels**
- 27/02 • Cable inlets [7]
- 29/00 Cooling or heating arrangements** (reflectors specially adapted for cooling F21V 7/20; cooling of air-treatment systems with air-flow over lighting fixtures F24F 3/056; lighting fixtures combined with outlets for air-treatment systems F24F 13/078; cooling of projectors G03B 21/16) [1, 7]
- 29/02 • Cooling by forcing air over or around the light source (cooling arrangements structurally associated with electric lamps H01J 61/52, H01K 1/58) [7]
- 31/00 Gas-tight or water-tight arrangements**
- 31/03 • with provision for venting [7]
- 31/04 • Provision of filling media (safety devices F21V 25/00; cooling arrangements F21V 29/00)
- 33/00 Structural combinations of lighting devices with other articles, not otherwise provided for** [1, 7]
- 35/00 Candle holders**
- 36/00 Arrangements of mantles or other incandescent bodies on burners** (attaching to lamp parts F21V 19/06)
- 36/02 • in ceiling lamps
- 37/00 Details of lighting devices employing combustion as light source, not otherwise provided for** [1, 7]
- 37/02 • Special adaptation for protection against draughts [7]
- 99/00 Subject matter not provided for in other groups of this subclass** [2006.01]

**F21W INDEXING SCHEME ASSOCIATED WITH SUBCLASSES F21L, F21S and F21V, RELATING TO USES OR APPLICATIONS OF LIGHTING DEVICES OR SYSTEMS [7]**

**Note(s)**

This subclass constitutes an indexing scheme associated with subclasses F21L, F21S and F21V, relating to uses or applications of lighting devices or systems.

<p><b>101/00 Use or application of lighting devices on or in vehicles [7]</b></p> <p>101/02 • for land vehicles [7]</p> <p>101/023 • • for cycles [7]</p> <p>101/027 • • • for motorcycles [7]</p> <p>101/04 • for water vehicles [7]</p> <p>101/06 • for aircraft [7]</p> <p>101/08 • Interior lights [7]</p> <p>101/10 • Head-, spot- or fog-lights [7]</p> <p>101/12 • Direction indicator lights [7]</p> <p>101/14 • Rear or stop lights [7]</p> <p><b>111/00 Use or application of lighting devices or systems for signalling, marking or indicating, not provided for in group F21W 101/00 [7]</b></p> <p>111/02 • for roads, paths or the like [7]</p> <p>111/023 • • for pedestrian walkways [7]</p> <p>111/027 • • for indicating kerbs, steps or stairs [7]</p> <p>111/04 • for waterways [7]</p> <p>111/043 • • for lighthouses or lightships [7]</p> <p>111/047 • • for light-buoys [7]</p> <p>111/06 • for aircraft runways or the like [7]</p> <p>111/08 • for handles or handrails [7]</p> <p>111/10 • for personal use, e.g. hand-held [7]</p> <p><b>121/00 Use or application of lighting devices or systems for decorative purposes [7]</b></p> <p>121/02 • for fountains [7]</p> <p>121/04 • for Christmas trees [7]</p> <p>121/06 • for personal wear [7]</p>	<p><b>131/00 Uses or applications of lighting devices or systems not provided for in groups F21W 101/00-F21W 121/00 [7]</b></p> <p>131/10 • Outdoor lighting [7]</p> <p>131/101 • • of tunnels or the like, e.g. under bridges [7]</p> <p>131/103 • • of streets or roads [7]</p> <p>131/105 • • of arenas or the like [7]</p> <p>131/107 • • of the exterior of buildings [7]</p> <p>131/109 • • of gardens [7]</p> <p>131/20 • Lighting for medical use [7]</p> <p>131/202 • • for dentistry [7]</p> <p>131/205 • • for operating theatres [7]</p> <p>131/208 • • for hospital wards [7]</p> <p>131/30 • Lighting for domestic or personal use [7]</p> <p>131/301 • • for furniture [7]</p> <p>131/302 • • for mirrors [7]</p> <p>131/304 • • for pictures [7]</p> <p>131/305 • • for refrigerators [7]</p> <p>131/307 • • for ovens [7]</p> <p>131/308 • • for aquaria [7]</p> <p>131/40 • Lighting for industrial, commercial, recreational or military use [7]</p> <p>131/401 • • for swimming pools [7]</p> <p>131/402 • • for working places [7]</p> <p>131/403 • • for machines [7]</p> <p>131/4035 • • • for sewing machines [7]</p> <p>131/405 • • for shop-windows or displays [7]</p> <p>131/406 • • for theatres, stages or film studios [7]</p> <p>131/407 • • for indoor arenas [7]</p> <p>131/409 • • for furnaces or kilns [7]</p> <p>131/411 • • for inspection of the interior of hollow structures, e.g. vessels, tubes [7]</p>
<p><b>F21Y INDEXING SCHEME ASSOCIATED WITH SUBCLASSES F21L, F21S and F21V, RELATING TO THE FORM OF THE LIGHT SOURCES [7]</b></p>	

**Note(s)**

This subclass constitutes an indexing scheme associated with subclasses F21L, F21S and F21V, relating to the form of the light sources.

<p><b>101/00 Point-like light sources [7]</b></p> <p>101/02 • Miniature, e.g. light emitting diodes (LED) [7]</p> <p><b>103/00 Elongated light sources, e.g. fluorescent tubes [7]</b></p> <p>103/02 • curved, e.g. ring-shaped [7]</p> <p>103/025 • • U-shaped [7]</p>	<p><b>105/00 Planar light sources [7]</b></p> <p><b>111/00 Light sources of form not covered by groups F21Y 101/00-F21Y 105/00 [7]</b></p> <p><b>113/00 Combination of light sources [7]</b></p> <p>113/02 • of different form [7]</p>
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## F22 STEAM GENERATION

**Note(s)**

In this class, the following term is used with the meaning indicated:

- "steam" covers also other condensable vapours, e.g. mercury, diphenyl, diphenyl oxide.

**F22B METHODS OF STEAM GENERATION; STEAM BOILERS** (steam engine plants where engine aspects predominate F01K; removal of combustion products or residues, e.g. cleaning of the combustion contaminated surfaces of tubes of boilers, F23J 3/00; domestic central-heating systems using steam F24D; heat exchange or heat transfer in general F28; generation of vapour in the cores of nuclear reactors G21)

**Note(s)**

This subclass covers only methods of, or apparatus for, the generation of steam under pressure for heating or power purposes.

**Subclass index**

METHODS FOR STEAM GENERATION.....	1/00, 3/00
STEAM BOILERS	
General characteristics	
having drum; having furnace tube; having fire tube; having combined fire tube and water tube;	
having fire-box.....	5/00, 7/00, 9/00, 11/00, 13/00
having water tubes	
auxiliary tubes.....	11/00
horizontal; horizontally-inclined; combined horizontally-inclined and vertical; vertical or	
steeply-inclined.....	15/00, 17/00, 19/00, 21/00
formed of sets of spaced double-walled water tubes or of return tubes; water tubes with	
internally-arranged flue tubes.....	23/00, 25/00
Special characteristics.....	27/00, 29/00
Modifications or arrangements; details of general application.....	31/00, 37/00
PLANTS; CONTROL SYSTEMS.....	33/00, 35/00

<b>1/00</b>	<b>Methods of steam generation characterised by form of heating method</b> (use of solar heat F24J 2/00; jackets or other cooling means in which steam is generated and which serve for cooling other apparatus, <u>see</u> the subclasses for such apparatus)	1/26	• • Steam boilers of submerged-flame type, i.e. the flame being surrounded by, or impinging on, the water to be vaporised
1/02	• by exploitation of the heat content of hot heat carriers	1/28	• in boilers heated electrically
1/04	• the heat carrier being hot slag, hot residues, or heated blocks, e.g. iron blocks	1/30	• • Electrode boilers
1/06	• • the heat carrier being molten; Use of molten metal, e.g. zinc, as heat transfer medium	<b>3/00</b>	<b>Other methods of steam generation; Steam boilers not provided for in other groups of this subclass</b>
1/08	• • the heat carrier being steam	3/02	• involving the use of working media other than water
1/10	• • • released from heat accumulators	3/04	• by drop in pressure of high-pressure hot water within pressure-reducing chambers, e.g. in accumulators (steam accumulators <u>per se</u> F01K 1/00)
1/12	• • • produced by an indirect cyclic process	3/06	• by transformation of mechanical, e.g. kinetic, energy into heat energy
1/14	• • • coming in direct contact with water in bulk or in sprays	3/08	• at critical or supercritical pressure values
1/16	• • the heat carrier being hot liquid or hot vapour, e.g. waste liquid, waste vapour	<b>5/00</b>	<b>Steam boilers of drum type, i.e. without internal furnace or fire tubes, the boiler body being contacted externally by flue gas</b>
1/18	• • the heat carrier being a hot gas, e.g. waste gas such as exhaust gas of internal-combustion engines (use of waste heat of combustion engines, in general, F02)	5/02	• with auxiliary water tubes outside the boiler body
1/20	• using heat evolved in a solution absorbing steam; Soda steam boilers	5/04	• Component parts thereof; Accessories therefor (covers or similar closure members for pressure vessels in general F16J 13/00)
1/22	• using combustion under pressure substantially exceeding atmospheric pressure	<b>7/00</b>	<b>Steam boilers of furnace-tube type, i.e. the combustion of fuel being performed inside one or more furnace tubes built-in in the boiler body</b>
1/24	• • Pressure-fired steam boilers, e.g. using turbo air compressors actuated by hot gases from boiler furnace	7/02	• without auxiliary water tubes
		7/04	• with auxiliary water tubes
		7/06	• • inside the furnace tube in transverse arrangement

- 7/08 • • inside the furnace tube in longitudinal arrangement
- 7/10 • • outside the boiler body
- 7/12 • with auxiliary fire tubes; Arrangement of header boxes providing for return diversion of flue gas flow
- 7/14 • with both auxiliary water tubes and auxiliary fire tubes
- 7/16 • Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- 7/18 • • Walling of flues; Flue-gas header boxes
- 7/20 • • Furnace tubes
- 9/00 Steam boilers of fire-tube type, i.e. the flue gas from a combustion chamber outside the boiler body flowing through tubes built-in in the boiler body**
- 9/02 • the boiler body being disposed upright, e.g. above the combustion chamber
- 9/04 • • the fire tubes being in upright arrangement
- 9/06 • • • Arrangement of header boxes providing for return diversion of flue gas flow
- 9/08 • • the fire tubes being in horizontal arrangement
- 9/10 • the boiler body being disposed substantially horizontally, e.g. at the side of the combustion chamber
- 9/12 • • the fire tubes being in substantially-horizontal arrangement
- 9/14 • • • Arrangement of header boxes providing for return diversion of flue gas flow
- 9/16 • the boiler body containing fire tubes disposed crosswise in inclined upward arrangement
- 9/18 • Component parts thereof; Accessories therefor, e.g. stay-bolt connections
- 11/00 Steam boilers of combined fire-tube type and water-tube type, i.e. steam boilers of fire-tube type having auxiliary water tubes**
- 11/02 • the fire tubes being in upright arrangement
- 11/04 • the fire tubes being in horizontal arrangement
- 13/00 Steam boilers of fire-box type, i.e. the combustion of fuel being performed in a chamber or fire-box with subsequent flue(s) or fire tube(s), both chamber or fire-box and flues or fire tubes being built-in in the boiler body**
- 13/02 • mounted in fixed position with the boiler body disposed upright
- 13/04 • mounted in fixed position with the boiler body disposed substantially horizontally
- 13/06 • Locomobile, traction-engine, steam-roller, or locomotive boilers
- 13/08 • • without auxiliary water tubes inside the fire-box
- 13/10 • • with auxiliary water tubes inside the fire-box
- 13/12 • • • the auxiliary water tubes lining the fire-box
- 13/14 • Component parts thereof; Accessories therefor
- 13/16 • • Stay-bolt connections, e.g. rigid connections
- 13/18 • • • Flexible connections, e.g. of ball-and-socket type
- 15/00 Water-tube boilers of horizontal type, i.e. the water-tube sets being arranged horizontally**
- 17/00 Water-tube boilers of horizontally-inclined type, i.e. the water-tube sets being inclined slightly with respect to the horizontal plane**
- 17/02 • built-up from water-tube sets in abutting connection with two header boxes in common for all sets, e.g. with flat header boxes
- 17/04 • • the water-tube sets being inclined in opposite directions, e.g. crosswise
- 17/06 • • the water-tube sets being bent angularly
- 17/08 • • the water-tube sets being curved
- 17/10 • built-up from water-tube sets in abutting connection with two sectional headers each for every set, i.e. with headers in a number of sections across the width or height of the boiler
- 17/12 • • the sectional headers being in vertical or substantially-vertical arrangement
- 17/14 • • the sectional headers being in horizontal or substantially-horizontal arrangement
- 17/16 • Component parts thereof; Accessories therefor
- 17/18 • • Header boxes; Sectional headers
- 19/00 Water-tube boilers of combined horizontally-inclined type and vertical type, i.e. water-tube boilers of horizontally-inclined type having auxiliary water-tube sets in vertical or substantially-vertical arrangement**
- 21/00 Water-tube boilers of vertical or steeply-inclined type, i.e. the water-tube sets being arranged vertically or substantially vertically**
- 21/02 • built-up from substantially-straight water tubes
- 21/04 • • involving a single upper drum and a single lower drum, e.g. the drums being arranged transversely
- 21/06 • • • the water tubes being arranged annularly in sets, e.g. in abutting connection with drums of annular shape
- 21/08 • • • the water tubes being arranged sectionally in groups or in banks, e.g. bent over at their ends
- 21/10 • • • the water tubes being arranged in staggered rows
- 21/12 • • involving two or more upper drums and two or more lower drums, e.g. with crosswise-arranged water-tube sets in abutting connection with drums
- 21/14 • • involving a single upper drum and two or more lower drums
- 21/16 • • • the lower drums being interconnected by further water tubes
- 21/18 • • involving two or more upper drums and a single lower drum
- 21/20 • • involving sectional or subdivided headers in separate arrangement for each water-tube set
- 21/22 • built-up from water tubes of form other than straight or substantially straight
- 21/24 • • bent in serpentine or sinuous form
- 21/26 • • bent helically, i.e. coiled
- 21/28 • • bent spirally
- 21/30 • • bent in U-loop form
- 21/32 • • • disposed horizontally in abutting connection with upright headers or rising water mains
- 21/34 • built-up from water tubes grouped in panel form surrounding the combustion chamber, i.e. radiation boilers
- 21/36 • • involving an upper drum or headers mounted at the top of the combustion chamber
- 21/38 • • Component parts thereof, e.g. prefabricated panels
- 21/40 • built-up from water tubes arranged in a comparatively long vertical shaft, i.e. tower boilers
- 23/00 Water-tube boilers built-up from sets of spaced double-walled water tubes of return type in unilateral abutting connection with a boiler drum or with a header box, i.e. built-up from Field water tubes comprising an inner tube arranged within an outer unilaterally-closed tube**

## F22B

- 23/02 • the water-tube, i.e. Field-tube, sets being horizontal or substantially horizontal
- 23/04 • the water-tube, i.e. Field-tube, sets being vertical or substantially vertical
- 23/06 • Component parts thereof, e.g. Field water tubes (heat-exchange tubes in general F28F)
- 25/00 Water-tube boilers built-up from sets of water tubes with internally-arranged flue tubes, or fire tubes, extending through the water tubes**
- 27/00 Instantaneous or flash steam boilers**
- 27/02 • built-up from fire tubes
- 27/04 • built-up from water tubes (F22B 27/12-F22B 27/16 take precedence)
- 27/06 • • bent in serpentine or sinuous form
- 27/08 • • bent helically, i.e. coiled
- 27/10 • • bent spirally
- 27/12 • built-up from rotary heat-exchange elements, e.g. from tube assemblies
- 27/14 • built-up from heat-exchange elements arranged within a confined chamber having heat-retaining walls
- 27/16 • involving spray nozzles for sprinkling or injecting water particles on to or into hot heat-exchange elements, e.g. into tubes
- 29/00 Steam boilers of forced-flow type**
- 29/02 • of forced-circulation type
- 29/04 • of combined-circulation type, i.e. in which convection circulation due to the difference in specific gravity between cold and hot water is promoted by additional measures, e.g. by injecting pressure-water temporarily
- 29/06 • of once-through type, i.e. built-up from tubes receiving water at one end and delivering superheated steam at the other end of the tubes (F22B 33/00 takes precedence)
- 29/08 • • operating with fixed point of final state of complete evaporation
- 29/10 • • operating with sliding point of final state of complete evaporation
- 29/12 • • operating with superimposed recirculation during starting and low-load periods, e.g. composite boilers
- 31/00 Modifications of boiler construction, or of tube systems, dependent on installation of combustion apparatus; Arrangements or dispositions of combustion apparatus** (steam generation characterised by heating method F22B 1/00; combustion apparatus per se F23)
- 31/02 • Installation of water-tube boilers in chimneys, e.g. in converter chimneys
- 31/04 • Heat supply by installation of two or more combustion apparatus, e.g. of separate combustion apparatus for the boiler and the superheater respectively
- 31/06 • • Installation of emergency heat supply
- 31/08 • Installation of heat-exchange apparatus or of means in boilers for heating air supplied for combustion
- 33/00 Steam-generation plants, e.g. comprising steam boilers of different types in mutual association** (arrangements or dispositions of steam-generation plants in marine vessels B63H 21/00)
- 33/02 • Combinations of boilers having a single combustion apparatus in common
- 33/04 • • of boilers of furnace-tube type with boilers of water-tube type
- 33/06 • • of boilers of furnace-tube type with boilers of fire-tube type
- 33/08 • • of boilers of water-tube type with boilers of fire-tube type
- 33/10 • • of two or more superposed boilers with separate water volumes and operating with two or more separate water levels
- 33/12 • Self-contained steam boilers, i.e. comprising as a unit the steam boiler, the combustion apparatus, the fuel storage, accessory machines, and equipment
- 33/14 • Combinations of low- and high-pressure boilers
- 33/16 • • of forced-flow type
- 33/18 • Combinations of steam boilers with other apparatus
- 35/00 Control systems for steam boilers** (regulation or control of steam power plants F01K 7/00; for regulating feed-water supply F22D; for controlling superheat temperature F22G 5/00; control of combustion F23N)
- 35/02 • for steam boilers with natural convection circulation
- 35/04 • • during starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- 35/06 • for steam boilers of forced-flow type
- 35/08 • • of forced-circulation type
- 35/10 • • of once-through type
- 35/12 • • • operating at critical or supercritical pressure
- 35/14 • • during the starting-up periods, i.e. during the periods between the lighting of the furnaces and the attainment of the normal operating temperature of the steam boilers
- 35/16 • • responsive to the percentage of steam in the mixture of steam and water
- 35/18 • Applications of computers to steam-boiler control
- 
- 37/00 Component parts or details of steam boilers** (venting devices F16K 24/00; steam traps or like apparatus F16T)
- 37/02 • applicable to more than one kind or type of steam boiler
- 37/04 • • and characterised by material, e.g. use of special steel alloy
- 37/06 • • Flue or fire tubes; Accessories therefor, e.g. fire-tube inserts
- 37/08 • • • Fittings preventing burning-off of the tube edges
- 37/10 • • Water tubes; Accessories therefor (working of metal tubes B21D; pipes in general F16L; repairing leaks in water tubes F16L 55/16, F28F 11/00; cleaning water tubes of boilers F23J, F28G; baffles, screens, or deflectors formed of water tubes F23M 9/10)
- 37/12 • • • Forms of water tubes, e.g. of varying cross-section
- 37/14 • • • Supply mains, e.g. rising mains, down-comers, in connection with water tubes
- 37/16 • • • Return bends
- 37/18 • • • Inserts, e.g. for receiving deposits from water
- 37/20 • • • Supporting arrangements, e.g. for securing water-tube sets (construction of tube walls of furnaces including boiler furnaces F23M 5/08)

- 37/22 • • Drums; Headers; Accessories therefor (making boilers from sheet metal B21D 51/24; pressure vessels in general F16J 12/00; covers or similar closure members for pressure vessels in general F16J 13/00)
- 37/24 • • Supporting, suspending, or setting arrangements, e.g. heat shielding (frames, engine beds F16M)
- 37/26 • • Steam-separating arrangements (vapour-liquid separators, e.g. for drying steam, B01D, B04)
- 37/28 • • • involving reversal of direction of flow
- 37/30 • • • using impingement against baffle separators
- 37/32 • • • using centrifugal force
- 37/34 • • Adaptations of boilers for promoting water circulation (auxiliary devices for promoting water circulation F22D 7/00)
- 37/36 • • Arrangements for sheathing or casing boilers
- 37/38 • • Determining or indicating operating conditions in steam boilers, e.g. monitoring direction or rate of water flow through water tubes (measuring or indicating instruments in general G01)
- 37/40 • • Arrangements of partition walls in flues of steam boilers, e.g. built-up from baffles (in flues or chimneys F23J 13/00)
- 37/42 • • Applications, arrangements, or dispositions of alarm or automatic safety devices (for feed-water heaters F22D 1/14; alarms responsive to undesired or abnormal conditions G08B)
- 37/44 • • • of safety valves (safety valves per se F16K)
- 37/46 • • • responsive to low or high water level, e.g. for checking, suppressing, extinguishing combustion in boilers (fire-fighting, fire extinction in general A62)
- 37/47 • • • responsive to abnormal temperature, e.g. actuated by fusible plugs (such alarms or devices per se G08B)
- 37/48 • • Devices or arrangements for removing water, minerals, or sludge from boilers (cleaning water tubes, furnace tubes, or the like of boilers F23J, F28G)
- Note(s)**  
Group F22B 37/48 covers only systems used while the boiler is in operation, or which remain in position while the boiler is in operation, or are specifically adapted to boilers without any other utility.
- 37/50 • • • for draining or expelling water
- 37/52 • • • Washing-out devices
- 37/54 • • • De-sludging or blow-down devices
- 37/56 • • Boiler-cleaning control devices, e.g. for ascertaining proper duration of boiler blow-down
- 37/58 • • Removing tubes from headers or drums; Extracting tools
- 37/60 • specially adapted for steam boilers of instantaneous or flash type
- 37/62 • specially adapted for steam boilers of forced-flow type
- 37/64 • • Mounting of, or supporting arrangements for, tube units (construction of tube walls of furnaces, e.g. boiler furnaces F23M 5/08)
- 37/66 • • • involving vertically-disposed water tubes
- 37/68 • • • involving horizontally-disposed water tubes
- 37/70 • • Arrangements for distributing water into water tubes
- 37/72 • • • involving injection devices
- 37/74 • • • Throttling arrangements for tubes or sets of tubes
- 37/76 • Adaptations or mounting of devices for observing existence or direction of fluid flow (devices per se G01P)
- 37/78 • Adaptations or mounting of level indicators (level indicators per se G01F)

**F22D PREHEATING, OR ACCUMULATING PREHEATED, FEED-WATER; FEED-WATER SUPPLY; CONTROLLING WATER LEVEL; AUXILIARY DEVICES FOR PROMOTING WATER CIRCULATION WITHIN BOILERS** (chemical treatment of water, e.g. purification, C02F; enclosed heat-exchange apparatus in general F28D; controlling in general G05)

**1/00 Feed-water heaters, e.g. preheaters**

- 1/02 • with water tubes arranged in the boiler furnace, fire tubes, or flue ways (heat-exchange tubes in general F28F)
- 1/04 • • the tubes having plain outer surfaces, e.g. in vertical arrangement
- 1/06 • • • in horizontal arrangement
- 1/08 • • the tubes having fins, ribs, gills, corrugations, or the like on their outer surfaces, e.g. in vertical arrangement
- 1/10 • • • in horizontal arrangement (hollow fire-bars, grates, or the like used as water tubes F23H 3/02)
- 1/12 • • Control devices, e.g. for regulating steam temperature
- 1/14 • • Safety or venting devices (safety devices for boilers in general F22B 37/42)
- 1/16 • with water tubes arranged otherwise than in the boiler furnace, fire tubes, or flue ways
- 1/18 • • and heated indirectly
- 1/20 • • and directly connected to boilers
- 1/22 • • and provided for rotary movement
- 1/24 • with fire tubes or flue ways traversing feed-water vessels
- 1/26 • with means, other than tubes, to separate water and heating medium, e.g. bulk heaters without internal flues or tubes, jacketed smoke-boxes or flues
- 1/28 • for direct heat transfer, e.g. by mixing water and steam
- 1/30 • • with stages, steps, baffles, dishes, circular troughs, or other means to cause interrupted or cascading fall of water
- 1/32 • arranged to be heated by steam, e.g. bled from turbines
- 1/34 • • and returning condensate to boiler with main feed supply
- 1/36 • Water and air preheating systems
- 1/38 • • Constructional features of water and air preheating systems
- 1/40 • Combinations of exhaust-steam and smoke-gas preheaters (for locomotives F22D 1/42)
- 1/42 • specially adapted for locomotives
- 1/44 • • Smoke-gas preheaters
- 1/46 • • Exhaust-steam preheaters
- 1/48 • • Details

## F22D

- 1/50 • incorporating thermal de-aeration of feed-water (de-aeration produced in the course of direct heat transfer F22D 1/28; thermal de-aeration of water per se B01D 19/00, C02F 1/20; valves for venting F16K 24/04) [3]

### 3/00 Accumulators for preheated water

- 3/02 • arranged within combustion chambers  
3/04 • combined with steam accumulators  
3/06 • directly connected to boilers  
3/08 • specially adapted for locomotives (locomotive boilers F22B 13/06)  
3/10 • • Control devices (controlling water feed to boilers, or water level F22D 5/00)

### 5/00 Controlling water feed or water level; Automatic water feeding or water-level regulators (steam traps F16T; measuring or indicating instruments G01; for indicating water level G01F; level control in general G05D 9/00)

- 5/02 • with an intermediate compartment from which the water is fed by gravity after mechanically moving the compartment, the movement being controlled according to water level  
5/04 • with pivoting buckets  
5/06 • with receptacles external to, but in free communication with, the boilers and adapted to move up and down in accordance with change in water level  
5/08 • with float-actuated valves  
5/10 • • and with pistons or membranes unitary with the feed inlet valves  
5/12 • • and with dipping tubes  
5/14 • responsive to thermal expansion and contraction, e.g. of solid elements

- 5/16 • • of fluids  
5/18 • for varying the speed or delivery pressure of feed pumps  
5/20 • • without floats  
5/22 • • with floats  
5/24 • with electric switches  
5/26 • Automatic feed-control systems (automatic safety devices F22B 37/42; controlling in general G05)  
5/28 • • responsive to amount of steam withdrawn; responsive to steam pressure  
5/30 • • responsive to both water level and amount of steam withdrawn or steam pressure  
5/32 • • influencing the speed or delivery pressure of the feed pumps  
5/34 • • Applications of valves (valves per se F16K)  
5/36 • • for feeding a number of steam boilers designed for different ranges of temperature and pressure

### 7/00 Auxiliary devices for promoting water circulation (adaptation of boilers for promoting water circulation F22B 37/34)

- 7/02 • Saddles or like directing plates fitted to furnace tubes  
7/04 • Injectors for water or steam  
7/06 • Rotary devices, e.g. propellers  
7/08 • • Arrangements of pumps, e.g. outside the boilers  
7/10 • • within the boilers  
7/12 • Control devices  
7/14 • specially adapted for locomotive boilers

### 11/00 Feed-water supply not provided for in other main groups

- 11/02 • Arrangements of feed-water pumps (F22D 11/06 takes precedence; pumps per se F04)  
11/04 • • with means to eliminate steam formation  
11/06 • • for returning condensate to boiler

## F22G SUPERHEATING OF STEAM (steam-separating arrangements in boilers F22B 37/26; removal of combustion products or residues, e.g. cleaning of the combustion contaminated surfaces of tubes of boilers, F23J 3/00)

### 1/00 Steam superheating characterised by heating method (exothermal chemical reactions not involving a supply of free oxygen gas, apparatus or devices for using the heat therefrom F24J)

- 1/02 • with heat supply by hot flue gases from the furnace of the steam boiler  
1/04 • • by diverting flow or hot flue gases to separate superheaters operating in reheating cycle, e.g. for reheating steam between a high-pressure turbine stage and an intermediate turbine stage  
1/06 • with heat supply predominantly by radiation  
1/08 • • from heated brickwork or the like  
1/10 • with provision for superheating by throttling  
1/12 • by mixing steam with furnace gases or other combustion products  
1/14 • using heat generated by chemical reactions  
1/16 • by using a separate heat source independent from heat supply of the steam boiler, e.g. by electricity, by auxiliary combustion of fuel oil

### 3/00 Steam superheaters characterised by constructional features; Details or component parts thereof (general aspects of enclosed heat-exchangers F28D)

### 5/00 Controlling superheat temperature (control systems for steam boilers F22B; regulating or controlling in general G05)

- 5/02 • Applications of combustion-control devices, e.g. tangential-firing burners, tilting burners  
5/04 • by regulating flue gas flow, e.g. by proportioning or diverting  
5/06 • by recirculating flue gases  
5/08 • • preventing furnace gas backflow through recirculating fan  
5/10 • by displacing superheater sections  
5/12 • by tempering the superheated steam, e.g. by injected water sprays (spray-mixers B01F 5/18)  
5/14 • • by live steam  
5/16 • by indirectly cooling or heating the superheated steam in auxiliary enclosed heat-exchanger  
5/18 • by by-passing steam around superheater sections  
5/20 • by combined controlling procedures

### 7/00 Steam superheaters characterised by location, arrangement, or disposition

- 7/02 • in fire tubes  
7/04 • in jackets around fire tubes  
7/06 • in furnace tubes  
7/08 • in fire-boxes

- 7/10 • in smoke-boxes  
7/12 • in flues

- 7/14 • in water-tube boilers, e.g. between banks of water tubes

## F23 COMBUSTION APPARATUS; COMBUSTION PROCESSES

### Note(s)

In this class, the following terms or expressions are used with the meanings indicated:

- "combustion" means the direct combination of oxygen gas, e.g. in air, and a burnable substance. Any other heat-producing combination of chemical substances, e.g. hydrogen peroxide and methane, iron oxide and aluminium, is covered by section C or by subclass F24J;
- "combustion chamber" means a chamber in which fuel is burned to establish a self-supporting fire or flame and which surrounds that fire or flame;
- "burner" means a device by which fluent fuel is passed to a combustion space where it burns to produce a self-supporting flame;
- "air" means a mixture of gases containing free oxygen and able to promote or support combustion.

**F23B METHODS OR APPARATUS FOR COMBUSTION USING ONLY SOLID FUEL** (for combustion of fuels that are solid at room temperatures, but burned in melted form, e.g. candle wax, C11C 5/00, F23C, F23D; using solid fuel suspended in air F23C, F23D 1/00; using solid fuel suspended in liquids F23C, F23D 11/00; using solid fuel and fluent fuel simultaneously or alternately F23C, F23D 17/00)

### Note(s)

1. This subclass only covers combustion wherein the main body of fuel is either essentially stationary during combustion or mechanically transported, as opposed to pneumatically transported or suspended in air, during combustion.
2. In this subclass, the first place priority rule is applied, i.e. at each hierarchical level, classification is made in the first appropriate place.
3. In this subclass, methods are classified in the groups that cover the apparatus used. Methods that are not related to a particular type of apparatus are classified in group F23B 90/00.
4. In this subclass, it is desirable to add the indexing codes of groups F23B 101/00-F23B 103/00.

### Subclass index

#### COMBUSTION APPARATUS

Combinations of two or more combustion chambers.....	10/00
Specially adapted for portability or transportability.....	20/00
Functional types.....	30/00-60/00
Returning solid combustion residues to the combustion chamber.....	70/00
Creating a distinct flow path for flue gases or for non-combusted gases given off by the fuel.....	80/00
COMBUSTION METHODS NOT RELATED TO A PARTICULAR TYPE OF APPARATUS.....	90/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....	99/00

<b>10/00</b>	<b>Combustion apparatus characterised by the combination of two or more combustion chambers [2006.01, 2011.01]</b>	30/08	• • • with fuel-supporting surfaces that move through the combustion zone, e.g. with chain grates [2006.01]
10/02	• including separate secondary combustion chambers [2011.01]	30/10	• • • with fuel-supporting surfaces having fuel advancing elements that are movable, but remain essentially in the same place, e.g. with rollers or reciprocating grate bars [2006.01]
<b>20/00</b>	<b>Combustion apparatus specially adapted for portability or transportability [2006.01]</b>	<b>40/00</b>	<b>Combustion apparatus with driven means for feeding fuel into the combustion chamber [2006.01]</b>
<b>30/00</b>	<b>Combustion apparatus with driven means for agitating the burning fuel; Combustion apparatus with driven means for advancing the burning fuel through the combustion chamber [2006.01]</b>	40/02	• the fuel being fed by scattering over the fuel-supporting surface [2006.01]
30/02	• with movable, e.g. vibratable, fuel-supporting surfaces; with fuel-supporting surfaces that have movable parts [2006.01]	40/04	• the fuel being fed from below through an opening in the fuel-supporting surface [2006.01]
30/04	• • with fuel-supporting surfaces that are rotatable around a horizontal or inclined axis and support the fuel on their inside, e.g. cylindrical grates [2006.01]	40/06	• the fuel being fed along the fuel-supporting surface [2006.01]
30/06	• • with fuel-supporting surfaces that are specially adapted for advancing the fuel through the combustion zone [2006.01]	40/08	• • into pot- or trough-shaped grates [2006.01]
		<b>50/00</b>	<b>Combustion apparatus in which the fuel is fed into or through the combustion zone by gravity, e.g. from a fuel storage situated above the combustion zone [2006.01]</b>

**F23B**

- 50/02 • the fuel forming a column, stack or thick layer with the combustion zone at its bottom [2006.01]
- 50/04 • • the movement of combustion air and flue gases being substantially transverse to the movement of the fuel [2006.01]
- 50/06 • • the flue gases being removed downwards through one or more openings in the fuel-supporting surface [2006.01]
- 50/08 • • with fuel-deflecting bodies forming free combustion spaces inside the fuel layer [2006.01]
- 50/10 • • with the combustion zone at the bottom of fuel-filled conduits ending at the surface of a fuel bed [2006.01]
- 50/12 • the fuel being fed to the combustion zone by free fall or by sliding along inclined surfaces, e.g. from a conveyer terminating above the fuel bed [2006.01]

**60/00 Combustion apparatus in which the fuel burns essentially without moving [2006.01]**

- 60/02 • with combustion air supplied through a grate [2006.01]

**70/00 Combustion apparatus characterised by means for returning solid combustion residues to the combustion chamber [2006.01]**

**80/00 Combustion apparatus characterised by means creating a distinct flow path for flue gases or for non-combusted gases given off by the fuel [2006.01]**

- 80/02 • by means for returning flue gases to the combustion chamber or to the combustion zone [2006.01]
- 80/04 • by means for guiding the flow of flue gases, e.g. baffles [2006.01]

**90/00 Combustion methods not related to a particular type of apparatus [2006.01, 2011.01]**

- 90/02 • Start-up techniques [2011.01]
- 90/04 • including secondary combustion (in separate combustion chambers F23B 10/02) [2011.01]
- 90/06 • • the primary combustion being a gasification or pyrolysis in a reductive atmosphere [2011.01]
- 90/08 • • in the presence of catalytic material [2011.01]

**99/00 Subject matter not provided for in other groups of this subclass [2006.01]**

**Indexing scheme related to adaptation of combustion apparatus to boilers [2006.01]**

**101/00 Adaptation of combustion apparatus to boilers in which the combustion chamber is situated inside the boiler vessel, e.g. surrounded by cooled surfaces [2006.01]**

**103/00 Adaptation of combustion apparatus for placement in or against an opening of a boiler, e.g. for replacing an oil burner [2006.01]**

- 103/02 • for producing an essentially horizontal flame [2006.01]

**F23C METHODS OR APPARATUS FOR COMBUSTION USING FLUENT FUEL (burners F23D)**

**Note(s) [2006.01]**

In this subclass, methods are classified in the groups that cover the apparatus used.

**Subclass index**

**COMBUSTION APPARATUS SPECIALLY ADAPTED FOR COMBUSTION OF TWO OR MORE**

TYPES OF FUEL..... 1/00  
 COMBINATIONS OF TWO OR MORE COMBUSTION CHAMBERS..... 6/00  
 FUNCTIONAL TYPES OF COMBUSTION APPARATUS

Fluidised bed combustion..... 10/00  
 Catalytic combustion..... 13/00  
 Resonant combustion..... 15/00

**COMBUSTION APPARATUS CHARACTERISED BY SUBSYSTEMS**

Combustion chambers..... 3/00  
 Arrangement or mounting of burners..... 5/00  
 Air supply..... 7/00  
 Arrangements for returning flue gases or combustion products..... 9/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS..... 99/00

**1/00 Combustion apparatus specially adapted for combustion of two or more kinds of fuel simultaneously or alternately, at least one kind of fuel being fluent (combustion apparatus characterised by the combination of two or more combustion chambers F23C 6/00; pilot flame igniters F23Q 9/00) [1, 7, 2006.01]**

- 1/02 • lump and liquid fuel
- 1/04 • lump and gaseous fuel
- 1/06 • lump and pulverulent fuel
- 1/08 • liquid and gaseous fuel
- 1/10 • liquid and pulverulent fuel

- 1/12 • gaseous and pulverulent fuel

**3/00 Combustion apparatus characterised by the shape of the combustion chamber (F23C 15/00 takes precedence) [1, 7, 2006.01]**

**5/00 Combustion apparatus characterised by the arrangement or mounting of burners [1, 7, 2006.01]**

- 5/02 • Structural details of mounting
- 5/06 • • Provision for adjustment of burner position during operation
- 5/08 • Disposition of burners

- 5/14 • • to obtain a single flame of concentrated or substantially planar form, e.g. pencil or sheet flame (F23C 5/32 takes precedence) [3]
- 5/24 • • to obtain a loop flame
- 5/28 • • to obtain flames in opposing directions, e.g. impacting flames
- 5/32 • • to obtain rotating flames, i.e. flames moving helically or spirally [3]
- 6/00 Combustion apparatus characterised by the combination of two or more combustion chambers [3, 7, 2006.01]**
- 6/02 • in parallel arrangement [3]
- 6/04 • in series connection [3]
- 7/00 Combustion apparatus characterised by arrangements for air supply** (inlets for fluidisation air F23C 10/20) [1, 7, 2006.01]
- 7/02 • Disposition of air supply not passing through burner
- 7/04 • • to obtain maximum heat transfer to wall of combustion chamber
- 7/06 • • for heating the incoming air (arrangements of regenerators or recuperators F23L 15/00)
- 7/08 • • • indirectly by a secondary fluid other than the combustion products
- 9/00 Combustion apparatus characterised by arrangements for returning combustion products or flue gases to the combustion chamber** (fluidised bed combustion apparatus with means for recirculation of particles entrained from the bed F23C 10/02; fluidised bed combustion apparatus with devices for removal and partial reintroduction of material from the bed F23C 10/26) [1, 7, 2006.01]
- 9/06 • for completing combustion [3]
- 9/08 • for reducing temperature in combustion chamber, e.g. for protecting walls of combustion chamber [3]
- 10/00 Apparatus in which combustion takes place in a fluidised bed of fuel or other particles [7]**
- Note(s)**
- In this group, it is desirable to add the indexing code of group F23C 101/00.
- 10/01 • in a fluidised bed of catalytic particles [2006.01]
- 10/02 • with means specially adapted for achieving or promoting a circulating movement of particles within the bed or for a recirculation of particles entrained from the bed [7]
- 10/04 • • the particles being circulated to a section, e.g. a heat-exchange section or a return duct, at least partially shielded from the combustion zone, before being reintroduced into the combustion zone [7]
- 10/06 • • • the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed [7]
- 10/08 • • • characterised by the arrangement of separation apparatus, e.g. cyclones, for separating particles from the flue gases [7]
- 10/10 • • • • the separation apparatus being located outside the combustion chamber [7]
- 10/12 • • the particles being circulated exclusively within the combustion zone [7]
- 10/14 • • • the circulating movement being promoted by inducing differing degrees of fluidisation in different parts of the bed [7]
- 10/16 • specially adapted for operation at superatmospheric pressures, e.g. by the arrangement of the combustion chamber and its auxiliary systems inside a pressure vessel [7]
- 10/18 • Details; Accessories [7]
- 10/20 • • Inlets for fluidisation air, e.g. grids; Bottoms [7]
- 10/22 • • Fuel feeders specially adapted for fluidised bed combustion apparatus (F23C 10/26 takes precedence) [7]
- 10/24 • • Devices for removal of material from the bed (devices for controlling the level of the bed or the amount of material in the bed F23C 10/30) [7]
- 10/26 • • • combined with devices for partial reintroduction of material into the bed, e.g. after separation of agglomerated parts [7]
- 10/28 • • Control devices specially adapted for fluidised bed combustion apparatus [7]
- 10/30 • • • for controlling the level of the bed or the amount of material in the bed [7]
- 10/32 • • • • by controlling the rate of recirculation of particles separated from the flue gases [7]
- 13/00 Apparatus in which combustion takes place in the presence of catalytic material** (in a fluidised bed of catalytic particles F23C 10/01; radiant gas burners using catalysis for flameless combustion F23D 14/18) [2006.01]
- 13/02 • characterised by arrangements for starting the operation, e.g. for heating the catalytic material to operating temperature [2006.01]
- 13/04 • characterised by the arrangement of two or more catalytic elements in series connection [2006.01]
- 13/06 • in which non-catalytic combustion takes place in addition to catalytic combustion, e.g. downstream of a catalytic element [2006.01]
- 13/08 • characterised by the catalytic material [2006.01]
- 15/00 Apparatus in which combustion takes place in pulses influenced by acoustic resonance in a gas mass [2006.01]**
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**
- Indexing scheme associated with group F23C 10/00, relating to combustion in entrained fluidised beds. [7]**
- 101/00 Combustion in entrained fluidised beds, i.e. fluidised beds which have no distinct upper surface [7]**

**F23D BURNERS** (generating combustion products of high pressure or high velocity F23R)

**Subclass index**

BURNERS FOR PULVERULENT FUEL.....1/00  
 BURNERS FOR COMBUSTION OF A LIQUID  
 Using capillary action.....3/00

**F23D**

Using fuel evaporation; direct spraying action.....5/00, 11/00  
 Using fuel impingement on a surface.....7/00, 9/00  
 BURNERS FOR COMBUSTION OF A GAS.....14/00  
 BURNERS FOR COMBUSTION OF GASEOUS OR LIQUID OR PULVERULENT FUEL.....17/00  
 ASSEMBLIES OF TWO OR MORE BURNERS.....23/00  
 OTHER BURNERS.....99/00

**1/00 Burners for combustion of pulverulent fuel**  
 (arrangement or mounting of burners F23C 5/00)

- 1/02 • Vortex burners, e.g. for cyclone-type combustion apparatus
- 1/04 • Burners producing cylindrical flames without centrifugal action
- 1/06 • Burners producing sheet flames

**Combustion of a liquid**

**3/00 Burners using capillary action**

- 3/02 • Wick burners
- 3/04 • • with flame spreaders (F23D 3/12 takes precedence)
- 3/06 • • Inverted wick burners, e.g. for illumination
- 3/08 • • characterised by shape, construction, or material, of wick
- 3/10 • • Blue-flame burners
- 3/12 • • • with flame spreaders
- 3/14 • • • with mixing of air and fuel vapour in a chamber before the flame
- 3/16 • • using candles (candles *per se* C11C)
- 3/18 • • Details of wick burners
- 3/20 • • • Flame spreaders
- 3/22 • • • Devices for mixing evaporated fuel with air
- 3/24 • • • Carriers for wicks
- 3/26 • • • • Safety devices thereon
- 3/28 • • • Wick-adjusting devices
- 3/30 • • • • directly engaging with the wick
- 3/32 • • • • engaging with a tube carrying the wick
- 3/34 • • • • Wick stop devices; Wick-fixing devices
- 3/36 • • • Devices for trimming wicks
- 3/38 • • • Devices for replacement of wicks
- 3/40 • the capillary action taking place in one or more rigid porous bodies

**5/00 Burners in which liquid fuel evaporates in the combustion space, with or without chemical conversion of evaporated fuel**

- 5/02 • the liquid forming a pool, e.g. bowl-type evaporators, dish-type evaporators
- 5/04 • • Pot-type evaporators, i.e. using a partially-enclosed combustion space
- 5/06 • the liquid forming a film on one or more plane or convex surfaces
- 5/08 • • on cascaded surfaces
- 5/10 • • on grids
- 5/12 • Details
- 5/14 • • Maintaining predetermined amount of fuel in evaporator
- 5/16 • • Safety devices
- 5/18 • • Preheating devices

**7/00 Burners in which drops of liquid fuel impinge on a surface**

**9/00 Burners in which a stream of liquid fuel impinges intermittently on a hot surface**

**11/00 Burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space** (spraying in general B05B, B05D)

- 11/02 • the combustion space being a chamber substantially at atmospheric pressure
- 11/04 • the spraying action being obtained by centrifugal action
- 11/06 • • using a horizontal shaft
- 11/08 • • using a vertical shaft
- 11/10 • the spraying being induced by a gaseous medium, e.g. water vapour
- 11/12 • • characterised by the shape or arrangement of the outlets from the nozzle
- 11/14 • • • with a single outlet, e.g. slit
- 11/16 • • in which an emulsion of water and fuel is sprayed
- 11/18 • • the gaseous medium being water vapour generated at the nozzle
- 11/20 • • • the water vapour being superheated
- 11/22 • • the gaseous medium being vaporised fuel, e.g. for a soldering lamp
- 11/24 • by pressurisation of the fuel before a nozzle through which it is sprayed by a substantial pressure reduction into a space
- 11/26 • • with provision for varying the rate at which the fuel is sprayed
- 11/28 • • • with flow-back of fuel at the burner, e.g. using by-pass
- 11/30 • • • with return feed of uncombusted sprayed fuel to reservoir
- 11/32 • by electrostatic means
- 11/34 • by ultrasonic means
- 11/36 • Details
- 11/38 • • Nozzles (nozzles in general B05B); Cleaning devices therefor
- 11/40 • • Mixing tubes; Burner heads
- 11/42 • • Starting devices (igniting F23Q)
- 11/44 • • Preheating devices; Vaporising devices
- 11/46 • • Devices on the vaporiser for controlling the feeding of the fuel

**14/00 Burners for combustion of a gas, e.g. of a gas stored under pressure as a liquid [4]**

- 14/02 • Premix gas burners, i.e. in which gaseous fuel is mixed with combustion air upstream of the combustion zone [4]
- 14/04 • • induction type, e.g. Bunsen burner [4]
- 14/06 • • • with radial outlets at the burner head [4]
- 14/08 • • • with axial outlets at the burner head [4]
- 14/10 • • • with elongated tubular burner head [4]
- 14/12 • Radiant burners [4]

- 14/14 • • using screens or perforated plates [4]
- 14/16 • • using permeable blocks [4]
- 14/18 • • using catalysis for flameless combustion [4]
- 14/20 • Non-premix gas burners, i.e. in which gaseous fuel is mixed with combustion air on arrival at the combustion zone (F23D 14/30-F23D 14/44 take precedence) [4]
- 14/22 • • with separate air and gas feed ducts, e.g. with ducts running parallel or crossing each other [4]
- 14/24 • • • at least one of the fluids being submitted to a swirling motion [4]
- 14/26 • with provision for a retention flame (pilot flame igniters F23Q 9/00) [4]
- 14/28 • in association with a gaseous fuel source, e.g. acetylene generator, or a container for liquefied gas [4]
- 14/30 • Inverted burners, e.g. for illumination [4]
- 14/32 • using a mixture of gaseous fuel and pure oxygen or oxygen-enriched air (F23D 14/38 takes precedence) [4]
- 14/34 • Burners specially adapted for use with means for pressurising the gaseous fuel or the combustion air (F23D 14/38 takes precedence) [4]
- 14/36 • • in which the compressor and burner form a single unit [4]
- 14/38 • Torches, e.g. for cutting, brazing, welding or heating (nozzles F23D 14/48) [4]
- 14/40 • • for welding (F23D 14/44 takes precedence) [4]
- 14/42 • • for cutting (F23D 14/44 takes precedence) [4]
- 14/44 • • for use under water [4]
- 14/46 • Details [4]
- 14/48 • • Nozzles (for spraying or coating B05B) [4]
- 14/50 • • • Cleaning devices therefor [4]
- 14/52 • • • for torches; for blow-pipes [4]
- 14/54 • • • • for cutting or welding metal [4]
- 14/56 • • • for spreading the flame over an area, e.g. for desurfacing of solid material, for surface hardening, for heating workpieces (scarfing by applying flames B23K 7/00) [4]
- 14/58 • • • characterised by the shape or arrangement of the outlet or outlets from the nozzle, e.g. of annular configuration [4]
- 14/60 • • Devices for simultaneous control of gas and combustion air (regulation of combustion in general F23N) [4]
- 14/62 • • Mixing devices; Mixing tubes [4]
- 14/64 • • • with injectors [4]
- 14/66 • • Preheating the combustion air or gas [4]
- 14/68 • • Treating the combustion air or gas, e.g. by filtering, by moistening (in general B01) [4]
- 14/70 • • Baffles or like flow-disturbing devices [4]
- 14/72 • • Safety devices, e.g. operative in case of failure of gas supply (protection or supervision of pipe-line systems F17D 5/00) [4]
- 14/74 • • • Preventing flame lift-off (F23D 14/70 takes precedence) [4]
- 14/76 • • • Protecting flame and burner parts [4]
- 14/78 • • • Cooling burner parts [4]
- 14/80 • • • Selection of a non-toxic gas [4]
- 14/82 • • • Preventing flashback or blowback (F23D 14/70 takes precedence; in gas feed lines A62C 4/02) [4]
- 14/84 • • Flame spreading or otherwise shaping (F23D 14/70 takes precedence) [4]
- Other burners**
- 17/00 Burners for combustion simultaneously or alternately of gaseous or liquid or pulverulent fuel**
- 23/00 Assemblies of two or more burners** (gas burners with provision for a retention flame F23D 14/26; arrangement or mounting of burners F23C 5/00; for industrial furnaces F27)
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- 99/00 Subject matter not provided for in other groups of this subclass [2010.01]**

## F23G CREMATION FURNACES; CONSUMING WASTE OR LOW GRADE FUELS BY COMBUSTION

### Subclass index

CREMATION.....	1/00
CONSUMING WASTE OR LOW-GRADE FUELS BY COMBUSTION	
Processes; Functional types of apparatus.....	5/00
Adaptation for specific waste or fuels.....	7/00
Details; Accessories.....	5/44
Control or safety arrangements.....	5/50

- 1/00 Methods or apparatus specially adapted for cremation of human or animal carcasses**
- 5/05 • • • using drying grates [4]
- 5/08 • including supplementary heating [4]
- 5/10 • • using electric means [4]
- 5/12 • • using gaseous or liquid fuel (F23G 5/14 takes precedence) [4]
- 5/14 • • including pretreatment [4]
- 5/16 • • • in a separate combustion chamber [4]
- 5/18 • • • in a stack [4]
- 5/20 • with combustion in rotating or oscillating drums [4]
- 5/22 • • the drums being conically shaped [4]
- 5/02 • including pretreatment [4]
- 5/027 • • pyrolysing or gasifying (pyrolysis of sludge C02F 11/00; destructive distillation of carbonaceous materials C10B 53/00) [4]
- 5/033 • • comminuting or crushing [4]
- 5/04 • • drying [4]

**F23G**

- 5/24 • with combustion in a vertical, substantially cylindrical, combustion chamber [4]
- 5/26 • • having rotating bottom [4]
- 5/28 • • having raking arms [4]
- 5/30 • with combustion in a fluidised bed [4]
- 5/32 • in which the waste or low-grade fuel is subjected to a whirling movement, e.g. cyclonic incinerators [4]
- 5/34 • in which the waste or low-grade fuel is burnt in a pit or arranged in a heap for combustion [4]
- 5/36 • with combustion in a conical combustion chamber, e.g. "teepee" incinerators (F23G 5/22 takes precedence) [4]
- 5/38 • having multi-hearth arrangements [4]
- 5/40 • Portable or mobile apparatus [4]
- 5/42 • • of the basket type [4]
- 5/44 • Details; Accessories [4]
- 5/46 • • Recuperation of heat [4]
- 5/48 • • Preventing corrosion [4]
- 5/50 • Control or safety arrangements [4]

- 7/00 **Methods or apparatus, e.g. incinerators, specially adapted for combustion of specific waste or low grade fuels, e.g. chemicals** (F23G 1/00 takes precedence; incinerator closets A47K 11/02; oxidation of sludge C02F 11/06; incinerating radioactive waste G21F 9/00) [4, 2006.01]
  - 7/02 • of bagasse, megasse or the like [4]
  - 7/04 • of waste liquors, e.g. sulfite liquors [4]
  - 7/05 • of waste oils [4]
  - 7/06 • of waste gases or noxious gases, e.g. exhaust gases (exhaust apparatus for engines with means for rendering the exhaust innocuous, e.g. by thermal or catalytic conversion, F01N 3/08; combustion of uncombusted material from primary combustion within apparatus for combustion of solid or fluent fuel F23B, F23C) [4]
  - 7/07 • • in which combustion takes place in the presence of catalytic material [2006.01]
  - 7/08 • • using flares, e.g. in stacks [4]
  - 7/10 • of field or garden waste [4]
  - 7/12 • of plastics, e.g. rubber [4]
  - 7/14 • of contaminated soil, e.g. soil contaminated by oil [4]

**F23H GRATES** (inlets for fluidisation air for fluidised bed combustion apparatus F23C 10/20); **CLEANING OR RAKING GRATES**

**Subclass index**

GRATES

- With solid bars; with hollow bars..... 1/00, 3/00
- Double; inclined; revolving or rocking; travelling..... 5/00, 7/00, 9/00, 11/00
- Other types..... 13/00
- Details..... 17/00

CLEANING ARRANGEMENTS FOR GRATES, MOVING FUEL ALONG GRATE..... 15/00

- 1/00 Grates with solid bars** (double grates F23H 5/00)
  - 1/02 • having provision for air supply or air preheating, e.g. air-supply or blast fittings which form part of the grate structure or serve as supports
  - 1/04 • having a variable burning surface
  - 1/06 • having bars at different levels
  - 1/08 • Vertical grates
- 3/00 Grates with hollow bars**
  - 3/02 • internally cooled
  - 3/04 • externally cooled, e.g. with water, steam, or air
- 5/00 Double grates**
- 7/00 Inclined grates** (inclined travelling grates F23H 11/12)
  - 7/02 • with fixed bars
  - 7/04 • • in parallel disposition
  - 7/06 • with movable bars disposed parallel to direction of fuel feeding
    - 7/08 • • reciprocating along their axes
    - 7/10 • • rocking about their axes
  - 7/12 • with movable bars disposed transversely to direction of fuel feeding
    - 7/14 • • reciprocating along their axes
    - 7/16 • • rocking about their axes
    - 7/18 • • reciprocating in an upward direction
- 9/00 Revolving grates; Rocking grates** (F23H 7/00 takes precedence)
  - 9/02 • Revolving cylindrical grates

- 9/04 • Grates rocked as a whole
- 9/06 • the bars being rocked about axes transverse to their lengths
- 9/08 • the bars being rocked about their longitudinal axes
- 9/10 • • and modified to move fuel along the grate
- 9/12 • the bars being vertically movable in a plane
- 11/00 Travelling grates**
  - 11/02 • with the bars disposed on transverse bearers
  - 11/04 • with the bars pivoted at one side
  - 11/06 • with the bars movable relatively to one another
  - 11/08 • with several individually-movable grate surfaces
  - 11/10 • with special provision for supply of air from below and for regulating air supply
  - 11/12 • inclined travelling grates; Stepped travelling grates
  - 11/14 • serving as auxiliary grates
  - 11/16 • for multi-layer stoking
  - 11/18 • Details
    - 11/20 • • Driving means
    - 11/22 • • Moving fuel along grate; Cleaning of grate
    - 11/24 • • Removal of ashes; Removal of clinker
    - 11/26 • • • by dumping
    - 11/28 • • Replaceable burning-surface
- 13/00 Grates not covered by any of groups F23H 1/00-F23H 11/00**
  - 13/02 • Basket grates, e.g. with shaking arrangement
  - 13/04 • Telescoping grates
  - 13/06 • Dumping-grates

13/08	• Grates specially adapted for gas generators and also applicable to furnaces	17/00	<b>Details of grates</b>
15/00	<b>Cleaning arrangements for grates</b> (not forming part of the grate F23J 1/00); <b>Moving fuel along grate</b> (rocking grates modified for moving fuel F23H 9/10; for travelling grates F23H 11/22)	17/02	• End fittings on bars
		17/04	• • of travelling grates
		17/06	• Provision for vertical adjustment of grate
		17/08	• Bearers; Frames; Spacers; Supports
		17/10	• • Dead plates; Imperforate fuel supports
		17/12	• Fire-bars
<b>F23J</b>	<b>REMOVAL OR TREATMENT OF COMBUSTION PRODUCTS OR COMBUSTION RESIDUES; FLUES</b> (precipitating dust from flue gases B01D; composition of fuels C10; combustion apparatus for consuming smoke or fumes, e.g. exhaust gases, F23G 7/06)		

**Note(s)**

1. This subclass covers also the cleaning of surfaces of furnace tubes, flame tubes, water tubes, flues or the like of boilers, heat-exchange or heat-transfer conduits, which surfaces are contaminated by combustion products or combustion residues.
2. This subclass does not cover the cleaning of surfaces of boilers, heat exchange or heat-transfer conduits contaminated by other than combustion products or combustion residues, which is covered by subclass F28G.

**Subclass index**

REMOVAL OF SOLID COMBUSTION PRODUCTS OR RESIDUES	
From combustion chamber.....	1/00
From places beyond the fire.....	3/00
TREATMENT OF COMBUSTION PRODUCTS OR RESIDUES	
Supply of chemicals; preventing solidification; Treating smoke or fumes.....	7/00, 9/00, 15/00
FLUES, FITTINGS FOR CHIMNEYS OR FLUES.....	11/00, 13/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....	99/00

1/00	<b>Removing ash, clinker, or slag from combustion chambers</b> (devices for removal of material from the bed of fluidised bed combustion apparatus F23C 10/24)	11/04	• in locomotives; in road vehicles; in ships
1/02	• Apparatus for removing ash, clinker, or slag from ash-pits, e.g. by employing trucks or conveyers, by employing suction devices	11/06	• • for conducting smoke horizontally
1/04	• Hand tools, e.g. rakes, prickers, tongs	11/08	• for portable apparatus
1/06	• Mechanically-operated devices, e.g. clinker pushers (forming part of the grate F23H)	11/10	• for tents; for log huts; for other inflammable structures
1/08	• Liquid slag removal [3]	11/12	• Smoke conduit systems for factories or large buildings
3/00	<b>Removing solid residues from passages or chambers beyond the fire, e.g. from flues by soot blowers</b>	13/00	<b>Fittings for chimneys or flues</b> (staying, stiffening E04H; means for facilitating climbing E06C; draught-inducing apparatus associated with chimneys or flues F23L)
3/02	• Cleaning furnace tubes; Cleaning flues or chimneys (by means which do not differ materially from the cleaning of any other tube once the fire is out B08B)	13/02	• Linings; Jackets; Casings
3/04	• Traps	13/04	• Joints; Connections (pipe joints in general F16L)
3/06	• Systems for accumulating residues from different parts of furnace plant	13/06	• Mouths; Inlet holes
7/00	<b>Arrangement of devices for supplying chemicals to fire</b> (supplying chemicals to fire C10L)	13/08	• Doors or covers specially adapted for smoke-boxes, flues, or chimneys (in general E06B)
9/00	<b>Preventing premature solidification of molten combustion residues</b>	15/00	<b>Arrangements of devices for treating smoke or fumes</b> (such devices <u>per se</u> , methods for treating smoke or fumes, <u>see</u> the relevant places for the treatment, e.g. B01D 53/00)
11/00	<b>Devices for conducting smoke or fumes, e.g. flues</b> (heat insulation therefor E04B 1/94; chimneys E04H 12/28; removing cooking fumes from domestic stoves or ranges F24C 15/20) [5]	15/02	• of purifiers, e.g. for removing noxious material (traps for solid residues F23J 3/04) [6]
11/02	• for conducting smoke or fumes originating from various locations to the outside, e.g. in locomotive sheds, in garages	15/04	• • using washing fluids [6]
		15/06	• of coolers [6]
		15/08	• of heaters [6]
		99/00	<b>Subject matter not provided for in other groups of this subclass [2006.01]</b>

**F23J**

**F23K FEEDING FUEL TO COMBUSTION APPARATUS** (fuel feeders specially adapted for fluidised bed combustion apparatus F23C 10/22; regulating or controlling combustion F23N)

- 1/00 Preparation of lump or pulverulent fuel in readiness for delivery to combustion apparatus** (filtration B01D; mixing B01F; pulverising B02C; drying F26B)
  - 1/02 • Mixing solid fuel with a liquid, e.g. preparing slurries
  - 1/04 • Heating fuel prior to delivery to combustion apparatus
- 3/00 Feeding or distributing of lump or pulverulent fuel to combustion apparatus** (conveying in general B65G)
  - 3/02 • Pneumatic feeding arrangements, i.e. by air blast
  - 3/04 • for locomotive boiler furnaces
  - 3/06 • for shaft-type furnaces
  - 3/08 • for furnaces having movable grate bars
  - 3/10 • Under-feed arrangements
  - 3/12 • • feeding by piston
  - 3/14 • • feeding by screw
  - 3/16 • Over-feed arrangements
  - 3/18 • • Spreader stokers
  - 3/20 • • • with moving hoppers
  - 3/22 • Controlling thickness of fuel bed
- 5/00 Feeding or distributing other fuel to combustion apparatus**
  - 5/02 • Liquid fuel [5]
  - 5/04 • • Feeding or distributing systems using pumps (F23K 5/06 takes precedence) [5]
  - 5/06 • • from a central source to a plurality of burners [5]
  - 5/08 • • Preparation of fuel [5]
  - 5/10 • • • Mixing with other fluids [5]
  - 5/12 • • • • Preparing emulsions (burners spraying an emulsion of water and fuel into the combustion space F23D 11/16) [5]
  - 5/14 • • Details thereof [5]
  - 5/16 • • • Safety devices (F23K 5/18 takes precedence; safety arrangements for combustion chambers F23M 11/00) [5]
  - 5/18 • • • Cleaning or purging devices, e.g. filters [5]
  - 5/20 • • • Preheating devices (in burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space F23D 11/44) [5]
  - 5/22 • • • Vaporising devices (in burners using a direct spraying action of liquid droplets or vaporised liquid into the combustion space F23D 11/44) [5]

**F23L AIR SUPPLY; DRAUGHT-INDUCING; SUPPLYING NON-COMBUSTIBLE LIQUID OR GAS** (air-supply arrangements for combustion apparatus using fluent fuel, e.g. fluidised bed combustion apparatus, F23C; dampers or throat restrictors for open fire-places F24; air inlet valves for open fire fronts F24)

**Subclass index**

**AIR SUPPLY**

- Passages for: primary air; secondary air..... 1/00, 9/00
- Valves or dampers
  - construction..... 13/00
  - arrangements: before the fire; after the fire..... 3/00, 11/00
- Blast-producing apparatus before the fire; heating of air for combustion..... 5/00, 15/00

- SUPPLYING NON-COMBUSTIBLE LIQUIDS OR GASES, OTHER THAN AIR, TO THE FIRE..... 7/00
- DRAUGHT-INDUCING..... 17/00
- SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS..... 99/00

- 1/00 Passages or apertures for delivering primary air for combustion**
  - 1/02 • by discharging the air below the fire
- 3/00 Arrangements of valves or dampers before the fire**
- 5/00 Blast-producing apparatus before the fire**
  - 5/02 • Arrangements of fans or blowers (fans or blowers per se F04)
  - 5/04 • by induction of air for combustion, e.g. using steam jet
- 7/00 Supplying non-combustible liquids or gases, other than air, to the fire, e.g. oxygen, steam**
- 9/00 Passages or apertures for delivering secondary air for completing combustion of fuel**
  - 9/02 • by discharging the air above the fire
  - 9/04 • by discharging the air beyond the fire, i.e. nearer the smoke outlet
- 9/06 • by discharging the air into the fire bed
- 11/00 Arrangements of valves or dampers after the fire**
  - 11/02 • for reducing draught by admission of air to flues
- 13/00 Construction of valves or dampers for controlling air supply or draught** (in general F16K)
  - 13/02 • pivoted about a single axis but having no other movement (formed as linked slats each pivoted about an axis F23L 13/08)
  - 13/04 • • with axis perpendicular to face
  - 13/06 • slidable only
  - 13/08 • operating as a roller blind; operating as a venetian blind
  - 13/10 • having a compound movement involving both sliding and pivoting
- 15/00 Heating of air supplied for combustion**
  - 15/02 • Arrangements of regenerators

- 15/04 • Arrangements of recuperators
- 17/00 Inducing draught**
- 17/02 • Tops for chimneys or ventilating shafts; Terminals for flues
- 17/04 • • Balanced-flue arrangements, i.e. devices which combine air inlet to combustion unit with smoke outlet
- 17/06 • • branched; T-headed
- 17/08 • • with coaxial cones or louvres
- F23M CONSTRUCTIONAL DETAILS OF COMBUSTION CHAMBERS, NOT OTHERWISE PROVIDED FOR** (construction or support of tube walls for steam boilers F22B; generating combustion products of high pressure or high velocity F23R)
- 3/00 Firebridges** (baffles not confining the fire F23M 9/06)
- 3/02 • modified for circulation of fluids, e.g. air, steam, water
- 3/04 • • for delivery of gas, e.g. air, steam
- 3/06 • • • into or towards fire
- 3/08 • • • away from fire, e.g. towards smoke outlet
- 3/10 • • • transversely
- 3/12 • characterised by shape or construction (F23M 3/02 takes precedence)
- 3/14 • • with apertures for passage of combustion products
- 3/16 • • built-up in sections, e.g. using bars or blocks
- 3/18 • • double; multiple
- 3/20 • • comprising loose refractory material, wholly or in part
- 3/22 • movable; adjustable
- 5/00 Casings; Linings; Walls** (casings, linings, or walls of heat-treatment chambers of ovens, kilns, or retorts F27D)
- 5/02 • characterised by the shape of the bricks or blocks used (ceramic materials C04B 33/00, C04B 35/00)
- 5/04 • Supports for linings
- 5/06 • Crowns or roofs for combustion chambers (F23M 5/02, F23M 5/04 take precedence)
- 5/08 • Cooling thereof; Tube walls
- F23N REGULATING OR CONTROLLING COMBUSTION** (control devices specially adapted for combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles F23C 10/28; condition responsive controls for regulating combustion in domestic stoves with open fires for solid fuel F24B 1/187)
- 1/00 Regulating fuel supply**
- 1/02 • conjointly with air supply
- 1/04 • conjointly with air supply and with draught
- 1/06 • conjointly with draught
- 1/08 • conjointly with another medium, e.g. boiler water
- 1/10 • • and with air supply or draught
- 3/00 Regulating air supply or draught** (conjointly with fuel supply F23N 1/00)
- 3/02 • Regulating draught by direct pressure operation of single valves or dampers
- 3/04 • by operation of single valves or dampers by temperature-sensitive elements
- 3/06 • by conjoint operation of two or more valves or dampers (F23N 3/08 takes precedence)
- 3/08 • by power-assisted systems
- 5/00 Systems for controlling combustion** (F23N 1/00, F23N 3/00 take precedence)
- 5/02 • • wherein the top moves as a whole
- 17/12 • • Devices for fastening the top or terminal to chimney, shaft, or flue
- 17/14 • • Draining devices
- 17/16 • Induction apparatus, e.g. steam jet, acting on combustion products beyond the fire
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**
- 7/00 Doors specially adapted for combustion chambers** (in general E06B; for flues or smoke-boxes F23J 13/08)
- 7/02 • Frames therefor
- 7/04 • Cooling doors or door frames
- 9/00 Baffles or deflectors for air or combustion products; Flame shields**
- 9/02 • in air inlets
- 9/04 • with air-supply passages in the baffle or shield
- 9/06 • in fire-boxes
- 9/08 • Helical or twisted baffles or deflectors
- 9/10 • Baffles or deflectors formed as tubes, e.g. in water-tube boilers (interconnection of such tubes in boilers for fluid flow F22)
- 11/00 Safety arrangements** (by controlling combustion F23N 5/24)
- 11/02 • Preventing emission of flames or hot gases, or admission of air, through working or charging apertures
- 11/04 • Means for supervising combustion, e.g. window (alarm systems G08B)
- 99/00 Subject matter not provided for in other groups of this subclass [2010.01]**
- 5/02 • using devices responsive to thermal changes or to thermal expansion of a medium
- 5/04 • • using bimetallic elements
- 5/06 • • using bellows; using diaphragms
- 5/08 • • using light-sensitive elements
- 5/10 • • using thermocouples
- 5/12 • • using ionisation-sensitive elements, i.e. flame rods
- 5/14 • • using thermo-sensitive resistors
- 5/16 • using noise-sensitive detectors
- 5/18 • using detectors sensitive to rate of flow of air or fuel
- 5/20 • with a time programme acting through electrical means, e.g. using time-delay relays
- 5/22 • with a time programme acting through mechanical means, e.g. using cams
- 5/24 • Preventing development of abnormal or undesired conditions, i.e. safety arrangements (F23N 5/02-F23N 5/18 take precedence)
- 5/26 • Details

**Subclass index**

## IGNITERS

Mechanical.....	1/00
Using electric sparks.....	3/00, 5/00
Incandescent.....	7/00
With pilot flame.....	9/00
By catalysis.....	11/00
Other.....	13/00
REMOTE IGNITION.....	21/00
TESTING.....	23/00
LIGHTERS CONTAINING FUEL.....	2/00, 3/01, 7/00
EXTINGUISHING DEVICES.....	25/00

<b>1/00 Mechanical ignition</b> (lighters containing fuel F23Q 2/00; matches C06F)	<b>5/00 Make-and-break ignition, i.e. with spark generated between electrodes by breaking contact therebetween</b>
1/02 • using friction or shock effects	<b>7/00 Incandescent ignition; Ignition using electrically-produced heat, e.g. lighters for cigarettes; Electrically-heated glowing plugs</b>
1/04 • • on a part moved by the fuel-controlling member, e.g. by a tap on a gas cooker	7/02 • for igniting solid fuel
1/06 • • Portable igniters	7/04 • • with fans for transfer of heat to fuel
<b>2/00 Lighters containing fuel, e.g. for cigarettes</b>	7/06 • Igniters structurally associated with fluid-fuel burners (lighters containing fuel F23Q 2/00)
2/02 • Lighters with liquid fuel	7/08 • • for evaporating and igniting liquid fuel, e.g. in hurricane lanterns
2/04 • • with cerium-iron alloy and wick	7/10 • • for gaseous fuel, e.g. in welding appliances
2/06 • • • with friction wheel	7/12 • • • actuated by gas-controlling device
2/08 • • • • with ignition by spring action of the cover	7/14 • Portable igniters
2/10 • • • with other friction member	7/16 • • with built-in battery
2/12 • • with cerium-iron alloy without wick	7/18 • • with built-in generator
2/14 • • with cerium-iron alloy and torch ignited by striking or pushing	7/20 • • with built-in mains transformer
2/16 • Lighters with gaseous fuel, e.g. the gas being stored in liquid phase	7/22 • Details
2/167 • • with adjustable flame [3]	7/24 • • Safety arrangements
2/173 • • • Valves therefor [3]	7/26 • • • Provision for re-ignition
2/18 • Lighters with solid fuel	<b>9/00 Ignition by a pilot flame</b>
2/20 • • with cerium-iron alloy and friction wheel	9/02 • without interlock with main fuel supply
2/22 • • with cerium-iron alloy and tinder	9/04 • • for upright burners, e.g. gas-cooker burners
2/24 • • with ignition pills or strips with inflammable parts	9/06 • • for inverted burners, e.g. gas lamps
2/26 • • combined with liquid-fuel lighters	9/08 • with interlock with main fuel supply
2/28 • Lighters characterised by electrical ignition of the fuel	9/10 • • to determine the sequence of supply of fuel to pilot and main burners
2/30 • Lighters characterised by catalytic ignition of fuel	9/12 • • to permit the supply to the main burner in dependence upon existence of pilot flame
2/32 • Lighters characterised by being combined with other objects (combinations with smokers' equipment A24F)	9/14 • • • using electric means, e.g. by light-sensitive elements
2/34 • Component parts or accessories	<b>11/00 Arrangement of catalytic igniters</b>
2/36 • • Casings	11/04 • at the burner
2/38 • • • with containers for flints or tools	11/06 • remote from the burner, e.g. on the chimney of a lamp
2/40 • • Cover fastenings	11/08 • on a part moved by the fuel-controlling member
2/42 • • Fuel containers; Closures for fuel containers	11/10 • • and moving out of the flame after ignition
2/44 • • Wicks; Wick guides or fastenings	<b>13/00 Ignition not otherwise provided for</b>
2/46 • • Friction wheels; Arrangement of friction wheels	13/02 • using gas burners, e.g. gas pokers
2/48 • • Flints (composition, manufacture C06C 15/00); Guides for, or arrangements of, flints	13/04 • using portable burners, e.g. torches, fire pots
2/50 • • Protecting coverings	<b>21/00 Devices for effecting ignition from a remote location</b>
2/52 • • Filling devices	
<b>3/00 Ignition using electrically-produced sparks</b> (lighters containing fuel F23Q 2/28; sparking-plugs H01T 13/00)	
3/01 • Hand-held lighters, e.g. for cigarettes	

23/00	<b>Testing of ignition installations</b> (peculiar to internal-combustion engines F02P 17/00; testing of sparking plugs H01T 13/58)	23/08	• Testing of components
		23/10	• • electrically
23/02	• Testing of ignition timing	25/00	<b>Extinguishing devices, e.g. for blowing-out or snuffing candle flames</b>
<b>F23R</b>	<b>GENERATING COMBUSTION PRODUCTS OF HIGH PRESSURE OR HIGH VELOCITY, e.g. GAS-TURBINE COMBUSTION CHAMBERS</b> (fluidised bed combustion apparatus specially adapted for operation at superatmospheric pressures F23C 10/16)		
3/00	<b>Continuous combustion chambers using liquid or gaseous fuel [3]</b>	3/34	• • Feeding into different combustion zones [3]
3/02	• characterised by the air-flow or gas-flow configuration (reverse-flow combustion chambers F23R 3/54; cyclone or vortex type combustion chambers F23R 3/58) [3]	3/36	• • Supply of different fuels [3]
3/04	• • Air inlet arrangements [3]	3/38	• • comprising rotary fuel injection means [3]
3/06	• • • Arrangement of apertures along the flame tube [3]	3/40	• characterised by the use of catalytic means [3]
3/08	• • • • between annular flame tube sections, e.g. flame tubes with telescopic sections [3]	3/42	• characterised by the arrangement or form of the flame tubes or combustion chambers [3]
3/10	• • • • for primary air (F23R 3/06 takes precedence) [3]	3/44	• • Combustion chambers comprising a tubular flame tube within a tubular casing (reverse-flow combustion chambers F23R 3/54) [3]
3/12	• • • • inducing a vortex [3]	3/46	• • Combustion chambers comprising an annular arrangement of flame tubes within a common annular casing or within individual casings [3]
3/14	• • • • • by using swirl vanes [3]	3/48	• • • Flame tube interconnectors, e.g. cross-over tubes [3]
3/16	• • with devices inside the flame tube or the combustion chamber to influence the air or gas flow [3]	3/50	• • Combustion chambers comprising an annular flame tube within an annular casing (toroidal combustion chambers F23R 3/52) [3]
3/18	• • • Flame stabilising means, e.g. flame holders for after-burners of jet-propulsion plants [3]	3/52	• • Toroidal combustion chambers [3]
3/20	• • • • incorporating fuel injection means [3]	3/54	• • Reverse-flow combustion chambers [3]
3/22	• • • • movable, e.g. to an inoperative position; adjustable, e.g. self-adjusting [3]	3/56	• • Combustion chambers having rotary flame tubes [3]
3/24	• • • • of the fluid-screen type [3]	3/58	• • Cyclone or vortex type combustion chambers [3]
3/26	• • Controlling the air flow [3]	3/60	• • Support structures; Attaching or mounting means [3]
3/28	• characterised by the fuel supply [3]	5/00	<b>Continuous combustion chambers using solid or pulverulent fuel [3]</b>
3/30	• • comprising fuel prevapourising devices [3]	7/00	<b>Intermittent or explosive combustion chambers [3]</b>
3/32	• • • being tubular [3]		

## F24 HEATING; RANGES; VENTILATING

### Note(s)

In this class, the following terms are used with the meanings indicated:

- "stove" includes apparatus which may have an open fire, e.g. fireplace;
- "range" means an apparatus for cooking having elements that perform different cooking operations or cooking and heating operations.

### F24B DOMESTIC STOVES OR RANGES FOR SOLID FUELS; IMPLEMENTS FOR USE IN CONNECTION WITH STOVES OR RANGES [6]

1/00	<b>Stoves or ranges</b>	1/10	• • • with combustion in horizontal direction (F24B 1/14 takes precedence)
1/02	• Closed stoves	1/14	• • • with predistillation in the hopper
1/04	• • built-up from glazed tiles (F24B 1/08, F24B 1/16 take precedence)	1/16	• • with fuel storage in multiple or divided hoppers within the stove or range
1/06	• • • Construction of tiles or bracing means therefor, e.g. shim liner (forming of tiles B28B; glazing of tiles C04B)	1/18	• Stoves with open fires, e.g. fireplaces
1/08	• • with fuel storage in a single undivided hopper within stove or range	1/181	• • Free-standing fireplaces, e.g. for mobile homes [4]
		1/182	• • with additional provisions for cooking (other stoves with additional provisions for cooking F24B 1/26) [4]

**F24B**

- 1/183 • • with additional provisions for heating water [4]
- 1/185 • • with air-handling means, heat exchange means, or additional provisions for convection heating (F24B 1/183 takes precedence; component parts or accessories having air-handling means, heat exchange means, or additional provisions for convection heating F24B 1/191); Regulating combustion; Controls therefor [4]
- 1/187 • • • Condition responsive controls for regulating combustion (valves or dampers for air supply F23L) [4]
- 1/188 • • • characterised by use of heat exchange means (F24B 1/187 takes precedence) [4]
- 1/189 • • • characterised by air-handling means, i.e. of combustion-air, heated-air, or flue-gases, e.g. draught control dampers (F24B 1/187, F24B 1/188 take precedence) [4]
- 1/19 • • • • Supplying combustion-air [4]
- 1/191 • • Component parts; Accessories [4]
- 1/192 • • • Doors; Screens; Fuel guards [4]
- 1/193 • • • Grates; Irons [4]
- 1/195 • • • Fireboxes; Frames; Hoods; Heat reflectors [4]
- 1/197 • • • Hearths [4]
- 1/198 • • • Surrounds-fronts [4]
- 1/199 • • • Fuel-handling equipment [4]
- 1/20 • Ranges
- 1/22 • • in which the baking oven is arranged above the fire-box
- 1/24 • • with built-in masses for heat storage or heat insulation
- 1/26 • Stoves with additional provisions for cooking (stoves with open-fires with additional provisions for cooking F24B 1/182) [4]
- 1/28 • Combined installations of stoves or ranges, e.g. back-to-back stoves with a common fire-box
- 3/00 Heaters not covered by group F24B 1/00, e.g. charcoal brazier** (for cooking A47J 27/00-A47J 37/00)
- 5/00 Combustion-air or flue-gas circulation in or around stoves or ranges** (stoves with open fires with air-handling means F24B 1/185) [4]
- 5/02 • in or around stoves
- 5/04 • • the air or gas passing downwards through the bottom of the stove or fire grate
- 5/06 • in or around ranges
- 5/08 • • around the baking oven
- 7/00 Stoves, ranges, or flue-gas ducts, with additional provisions for convection heating** (stoves with open fires characterised by use of heat exchange means F24B 1/185; air heaters having heat generating means F24H 3/00) [4]
- 7/02 • with external air ducts
- 7/04 • with internal air ducts
- 7/06 • without air ducts
- 9/00 Stoves, ranges, or flue-gas ducts, with additional provisions for heating water** (F24B 1/182, F24B 1/183 take precedence) [3, 4]
- 9/02 • in open containers, e.g. bain-marie
- 9/04 • in closed containers [4]
- 13/00 Details solely applicable to stoves or ranges burning solid fuels** (component parts or accessories for stoves with open-fires F24B 1/191; removing ash, clinker or slag from combustion chambers F23J 1/00; removing solid residues from passages or chambers beyond the fire F23J 3/00; joints or connections for chimneys or flues F23J 13/04; mouths or inlet holes for chimneys or flues F23J 13/06; means for supervising combustion F23M 11/04) [4]
- 13/02 • Arrangement or mounting of fire-grate assemblies (grates F23H); Arrangement or mounting of linings for fire-boxes, e.g. fire-back (ceramic materials C04B 33/00, C04B 35/00; casings, linings, walls for combustion chambers F23M)
- 13/04 • Arrangements for feeding solid fuel, e.g. hoppers (feeding solid fuel to combustion apparatus in general F23K)
- 15/00 Implements for use in connection with stoves or ranges** (ash sieves B07B; firelighters C10L 11/00; removal of ashes F23J; other devices for igniting F23Q) [6]
- 15/02 • for breaking coal [6]
- 15/04 • Coal hods; Coal boxes [6]
- 15/06 • Shovels with ejectors [6]
- 15/08 • Shovels with sifters [6]
- 15/10 • Coal tongs [6]

**F24C OTHER DOMESTIC STOVES OR RANGES; DETAILS OF DOMESTIC STOVES OR RANGES, OF GENERAL APPLICATION** (radiator stoves of the fluid-circulating type F24H)

**Subclass index**

STOVES OR RANGES, NOT RESTRICTED TO SOLID FUEL

- General characteristics..... 1/00
- With single kind of fuel or energy supply..... 3/00-9/00
- With more than one, or unspecified kind of fuel or energy supply..... 1/00
- With additional means for heating water..... 13/00
- With self-cleaning provisions..... 14/00
- Combinations of stoves or ranges..... 11/00

DETAILS OF STOVES OR RANGES IN GENERAL..... 15/00

- 1/00 Stoves or ranges in which the fuel or energy supply is not restricted to solid fuel or to a type covered by a single one of groups F24C 3/00-F24C 9/00; Stoves or ranges in which the type of fuel or energy supply is not specified**
- 1/02 • adapted for the use of two or more kinds of fuel or energy supply (F24C 1/16 takes precedence; combinations of two or more stoves or ranges each having a different kind of fuel or energy supply F24C 11/00)

- 1/04 • • simultaneously
- 1/06 • • by replacing parts, e.g. replacing burner by electric heater
- 1/08 • solely adapted for radiation heating (F24C 1/16 takes precedence)
- 1/10 • • with reflectors
- 1/12 • • • of circular shape
- 1/14 • Radiation heating stoves or ranges, with additional provision for convection heating (F24C 1/02, F24C 1/16 take precedence; solely adapted for convection heating F24H)
- 1/16 • with special adaptation for travelling, e.g. collapsible
- 3/00 Stoves or ranges for gaseous fuels**
- 3/02 • with heat produced solely by flame (F24C 3/14 takes precedence)
- 3/04 • with heat produced wholly or partly by a radiant body, e.g. by a perforated plate (F24C 3/14 takes precedence)
- 3/06 • • without any visible flame
- 3/08 • Arrangement or mounting of burners (burners per se F23D)
- 3/10 • Arrangement or mounting of ignition devices (ignition devices per se F23Q)
- 3/12 • Arrangement or mounting of control or safety devices (control valves F16K; safety devices for burners F23D 14/72; regulating or controlling combustion F23N)
- 3/14 • with special adaptation for travelling, e.g. collapsible
- 5/00 Stoves or ranges for liquid fuels**
- 5/02 • with evaporation burners, e.g. dish type (F24C 5/20 takes precedence)
- 5/04 • • wick type
- 5/06 • • • adjustable
- 5/08 • • with heat produced wholly or partly by a radiant body
- 5/10 • with atomising burners (F24C 5/20 takes precedence)
- 5/12 • Arrangement or mounting of burners (burners per se F23D)
- 5/14 • Arrangement or mounting of ignition devices (ignition devices per se F23Q)
- 5/16 • Arrangement or mounting of control or safety devices (control valves F16K; safety devices for burners F23D; regulating or controlling combustion F23N)
- 5/18 • Liquid-fuel supply arrangements forming parts of stoves or ranges (feeding liquid fuel to combustion apparatus in general F23K)
- 5/20 • with special adaptation for travelling, e.g. collapsible
- 7/00 Stoves or ranges heated by electric energy** (electric heating elements or arrangements H05B)
- 7/02 • using microwaves (heating using microwaves in general H05B 6/64)
- 7/04 • with heat radiated directly from the heating element (F24C 7/10 takes precedence)
- 7/06 • Arrangement or mounting of electric heating elements
- 7/08 • Arrangement or mounting of control or safety devices (switches H01H; circuit arrangements for electric heating H05B)
- 7/10 • with special adaptation for travelling, e.g. collapsible
- 9/00 Stoves or ranges heated by a single type of energy supply not covered by groups F24C 3/00-F24C 7/00 or subclass F24B** (using the heat from an exothermal reaction not involving a supply of free oxygen gas, using solar energy F24J)
- 11/00 Combinations of two or more stoves or ranges, e.g. each having a different kind of energy supply**
- 13/00 Stoves or ranges with additional provisions for heating water [3]**
- 14/00 Stoves or ranges having self-cleaning provisions, e.g. continuous or catalytic cleaning, electrostatic cleaning [3]**
- 14/02 • pyrolytic type [3]
- 15/00 Details** (electric heating elements or arrangements H05B)
- 15/02 • Doors specially adapted for stoves or ranges (in general E06B; for combustion chambers F23M)
- 15/04 • • with transparent panels
- 15/06 • Ornamental features, e.g. grate front, surround
- 15/08 • Foundations or support plates; Legs or pillars; Casings; Wheels (F24C 15/10 takes precedence)
- 15/10 • Tops, e.g. hot plate; Rings (F24C 15/12, F24C 15/14 take precedence)
- 15/12 • Side rests; Side plates; Cover lids; Splash guards; Racks outside ovens, e.g. for drying plates
- 15/14 • Spillage trays or grooves
- 15/16 • Shelves, racks, or trays inside ovens; Supports therefor
- 15/18 • Arrangement of compartments additional to cooking compartments, e.g. for warming, for storing utensils or fuel containers; Arrangement of additional heating or cooking apparatus, e.g. grills (grills per se A47J)
- 15/20 • Removing cooking fumes (parts, details or accessories of cooking-vessels for withdrawing or condensing cooking vapours from such vessels A47J 36/38) [5]
- 15/22 • Reflectors for radiation heaters
- 15/24 • Radiant bodies or panels for radiation heaters (radiant gas burners F23D 14/12)
- 15/26 • Handles for carrying
- 15/28 • Draught shields
- 15/30 • Arrangements for mounting stoves or ranges in particular locations
- 15/32 • Arrangements of ducts for hot gases, e.g. in or around baking ovens
- 15/34 • Elements or arrangements for heat storage or insulation
- 15/36 • Protective guards, e.g. for preventing access to heated parts

**F24C**

**F24D DOMESTIC- OR SPACE-HEATING SYSTEMS, e.g. CENTRAL HEATING SYSTEMS; DOMESTIC HOT-WATER SUPPLY SYSTEMS; ELEMENTS OR COMPONENTS THEREFOR** (preventing corrosion C23F; water supply in general E03; using steam or condensate extracted or exhausted from steam engine plants for heating purposes F01K 17/02; steam traps F16T; domestic stoves or ranges F24B, F24C; water or air heaters having heat generating means F24H; combined heating and refrigeration systems F25B; heat exchange apparatus or elements F28; removing furring F28G; electric heating elements or arrangements H05B)

**Note(s)**

In this subclass, the following expression is used with the meaning indicated:

- "central heating system" means a system in which heat is generated or stored at central sources and is distributed by means of a transfer fluid to the spaces or areas to be heated.

**Subclass index**

**CENTRAL HEATING SYSTEMS**

With heat-transfer fluid: steam; hot water; hot air or exhaust gas; other fluid.....1/00, 3/00, 5/00, 7/00  
 Combinations.....9/00  
 District heating systems.....10/00  
 By heat storage.....11/00  
 Other systems.....12/00

**OTHER DOMESTIC- OR SPACE-HEATING SYSTEMS**

Electric; Other.....13/00, 15/00

**DOMESTIC HOT-WATER SUPPLY.....17/00**

**DETAILS.....19/00**

**Central heating systems**

<p><b>1/00 Steam central heating systems</b> (F24D 10/00, F24D 11/00 take precedence)</p> <p>1/02 • operating with live steam</p> <p>1/04 • operating with exhaust steam</p> <p>1/06 • operating with superheated steam</p> <p>1/08 • Feed-line arrangements, e.g. providing for one-pipe system</p> <p><b>3/00 Hot-water central heating systems</b> (F24D 10/00, F24D 11/00 take precedence)</p> <p>3/02 • with forced circulation, e.g. by pumps</p> <p>3/04 • with the water under high pressure</p> <p>3/06 • • Arrangements or devices for maintaining high pressure</p> <p>3/08 • in combination with systems for domestic hot-water supply</p> <p>3/10 • Feed-line arrangements, e.g. providing for heat-accumulator tanks, expansion tanks</p> <p>3/12 • Tube and panel arrangements for ceiling, wall, or underfloor heating (electric underfloor heating F24D 13/02; special adaptations of floors for incorporating ducts, e.g. for heating or ventilating, E04B 5/48; building elements of block or other shape for the construction of parts of buildings characterised by special adaptations, e.g. serving for locating conduits, E04C 1/39; building elements of relatively thin form for the construction of parts of buildings with special adaptations for auxiliary purposes, e.g. serving for locating conduits, E04C 2/52) [4]</p> <p>3/14 • • incorporated in a ceiling, wall or floor [4]</p> <p>3/16 • • mounted on, or adjacent to, a ceiling, wall or floor [4]</p> <p>3/18 • using heat pumps [5]</p> <p><b>5/00 Hot-air central heating systems</b> (F24D 10/00, F24D 11/00 take precedence; air conditioning F24F); <b>Exhaust-gas central heating systems</b></p>	<p>5/02 • operating with discharge of hot air into the space or area to be heated</p> <p>5/04 • • with return of the air to the air heater</p> <p>5/06 • operating without discharge of hot air into the space or area to be heated</p> <p>5/08 • • with hot air led through radiators</p> <p>5/10 • • with hot air led through heat-exchange ducts in the walls, floor, or ceiling</p> <p>5/12 • using heat pumps [5]</p> <p><b>7/00 Central heating systems employing heat-transfer fluids not covered by groups F24D 1/00-F24D 5/00, e.g. oil, salt, gas</b> (F24D 10/00, F24D 11/00 take precedence)</p> <p><b>9/00 Central heating systems employing combinations of heat-transfer fluids covered by two or more of groups F24D 1/00-F24D 7/00</b> (F24D 10/00, F24D 11/00 take precedence)</p> <p>9/02 • Hot water and steam systems</p> <p><b>10/00 District heating systems [5]</b></p> <p><b>11/00 Central heating systems using heat accumulated in storage masses</b> (self-contained storage heating units F24D 15/02; storage masses, <u>see</u> the relevant subclasses)</p> <p>11/02 • using heat pumps</p> <p><b>12/00 Other central heating systems</b></p> <p>12/02 • having more than one heat source (F24D 3/18, F24D 5/12, F24D 11/02 take precedence) [5]</p>	<p><b>Other domestic- or space-heating systems</b></p> <p><b>13/00 Electric heating systems</b> (electric water or air heaters F24H)</p> <p>13/02 • solely using resistance heating, e.g. underfloor heating</p>
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13/04	• using electric heating of heat-transfer fluid in separate units of the system	19/00	<b>Details</b> (of water or air heaters F24H 9/00; of heat-exchange or heat-transfer apparatus, of general application F28F) [3]
<b>15/00</b>	<b>Other domestic- or space-heating systems</b>	19/02	• Arrangement of mountings or supports for radiators [3]
15/02	• consisting of self-contained heating units, e.g. storage heaters [3]	19/04	• • in skirtings [3]
15/04	• using heat pumps [5]	19/06	• Casings, cover lids or ornamental panels, for radiators [3]
<hr/>			
<b>17/00</b>	<b>Domestic hot-water supply systems</b> (combined with domestic- or space-heating systems F24D 1/00-F24D 15/00)	19/08	• Arrangements for drainage, venting or aerating (valves for drainage F16K, e.g. F16K 21/00, for venting or aerating F16K 24/00) [3]
17/02	• using heat pumps [5]	19/10	• Arrangement or mounting of control or safety devices (control valves F16K; only the heater being controlled F24H 9/20) [3]
<b>F24F</b>	<b>AIR-CONDITIONING; AIR-HUMIDIFICATION; VENTILATION; USE OF AIR CURRENTS FOR SCREENING</b> (devices for ventilating greenhouses A01G; animal husbandry A01K, e.g. controlling humidity in incubators A01K 41/04; disinfecting or sterilising of air A61L; devices for reconditioning breathing air in sealed rooms or for ventilating gasproof shelters A62B; filtering, washing or drying of gases B01D; mixing gases with vapours or liquids in general B01F 3/00; spraying B05B, B05D; removing dirt or fumes from areas where they are produced B08B 15/00; ventilation, air-conditioning, or cooling, specially adapted for vehicles, <u>see</u> the relevant vehicle places, e.g. B60H, B61D 27/00; production of ozone C01B 13/10; chimneys or flues E04F 17/02, E04H 12/28, F23J 11/00, F23L 17/02; air ducts or conduits E04F 17/04, F16L; ventilation in doors or windows E06B 7/02; fans, blowers F04; noise-absorbing in pipes or pipe systems F16L; tops for chimneys or ventilating shafts F23L; cooling F25; details of heat-exchange or heat-transfer apparatus, of general application F28F; apparatus for generating ions to be introduced into non-enclosed gases, e.g. the atmosphere, H01T 23/00)		

**Note(s)**

- In this subclass:
  - air-humidification as auxiliary treatment in air-conditioning, i.e. in units wherein the air is also either cooled or heated, is covered by groups F24F 1/00 or F24F 3/14;
  - air-humidification per se, e.g. "room humidifiers", is covered by group F24F 6/00.
- In this subclass, the following terms or expressions are used with the meanings indicated:
  - "air-conditioning" means the supply of air to rooms or spaces by means which provide for the treatment of the air in at least two of the following ways:  
heating — cooling — any other kind of treatment, e.g. humidification;
  - "ventilation" means the supply of air to, or its extraction from, rooms or spaces, and systems for circulating air within rooms or spaces, but does not cover the mere treatment of air being supplied to, extracted from, or circulated within, rooms or spaces.

**Subclass index**

AIR-CONDITIONING	Room units; central systems; other systems or apparatus.....	1/00, 3/00, 5/00
AIR-HUMIDIFICATION.....		6/00
VENTILATION.....		7/00
SCREENING BY AIR CURRENTS.....		9/00
COMMON DETAILS		
Control, safety.....		11/00
Use of energy recovery systems.....		12/00
Other details.....		13/00

**Air-conditioning**

- |             |   |
|-------------|---|
| <b>1/00</b> | <b>Room units, e.g. separate or self-contained units or units receiving primary air from a central station [1, 2011.01]</b>             |
| 1/01        | • in which secondary air is induced by injector action of the primary air (F24F 1/02 takes precedence) [3, 2011.01]                     |
| 1/02        | • self-contained, i.e. with all apparatus for treatment installed in a common casing [1, 2011.01]                                       |
| 1/04        | • • Arrangements for portability [1, 2011.01]   |
| 1/06        | • Separate outdoor units, e.g. outdoor unit to be linked to a separate room unit comprising a compressor and a heat exchanger [2011.01] |

**Note(s) [2011.01]**

In this group, at each hierarchical level, in the absence of an indication to the contrary, classification is made in the first appropriate place.

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|------|--|
| 1/08 | • • Compressors specially adapted for separate outdoor units [2011.01]     |
| 1/10 | • • • Arrangement or mounting thereof [2011.01]                            |
| 1/12 | • • • Vibration or noise prevention therefor [2011.01]                     |
| 1/14 | • • Heat exchangers specially adapted for separate outdoor units [2011.01] |
| 1/16 | • • • Arrangement or mounting thereof [2011.01]                            |
| 1/18 | • • • characterised by their shape [2011.01]                               |

- 1/20 • • Electric components for separate outdoor units [2011.01]
- 1/22 • • • Arrangement or mounting thereof [2011.01]
- 1/24 • • • Cooling of electric components [2011.01]
- 1/26 • • Refrigerant piping [2011.01]
- 1/28 • • • for connecting several separate outdoor units [2011.01]
- 1/30 • • • for use inside the separate outdoor units [2011.01]
- 1/32 • • • for connecting the separate outdoor unit to indoor units [2011.01]
- 1/34 • • • Protection means therefor, e.g. covers for refrigerant pipes [2011.01]
- 1/36 • • Drip trays for outdoor units [2011.01]
- 1/38 • • Fan details of outdoor units, e.g. bell-mouth shaped inlets or fan mountings [2011.01]
- 1/40 • • Vibration or noise prevention at outdoor units (for outdoor unit compressors F24F 1/12) [2011.01]
- 1/42 • • characterised by the use of the condensate, e.g. for enhanced cooling [2011.01]
- 1/44 • • characterised by the use of internal combustion engines [2011.01]
- 1/46 • • Component arrangements in separate outdoor units [2011.01]
- 1/48 • • • characterised by airflow, e.g. inlet or outlet airflow [2011.01]
- 1/50 • • • • with outlet air in upward direction [2011.01]
- 1/52 • • • • Inlet and outlet arranged on the same side, e.g. for mounting in a wall opening [2011.01]
- 1/54 • • • • Inlet and outlet arranged on opposite sides [2011.01]
- 1/56 • • Casing or covers of separate outdoor units, e.g. fan guards [2011.01]
- 1/58 • • • Separate protective covers for outdoor units, e.g. solar guards, snow shields or camouflage [2011.01]
- 1/60 • • Arrangement or mounting of the outdoor unit [2011.01]
- 1/62 • • • Wall-mounted [2011.01]
- 1/64 • • • Ceiling-mounted, e.g. below a balcony [2011.01]
- 1/66 • • • under the floor level [2011.01]
- 1/68 • • • Arrangement of multiple separate outdoor units [2011.01]
- 3/00 Air-conditioning systems in which conditioned primary air is supplied from one or more central stations to distributing units in the rooms or spaces where it may receive secondary treatment; Apparatus specially designed for such systems** (room units F24F 1/00; construction of heat-exchangers F28)
- 3/02 • characterised by the pressure or velocity of the primary air (F24F 3/044 takes precedence) [3]
- 3/04 • • operating with high pressure or high velocity
- 3/044 • Systems in which all treatment is given in the central station, i.e. all-air systems [3]
- 3/048 • • with temperature control at constant rate of air-flow (F24F 3/056 takes precedence) [3]
- 3/052 • • • Multiple duct systems, e.g. systems in which hot and cold air are supplied by separate circuits from the central station to mixing chambers in the spaces to be conditioned [3]
- 3/056 • • the air at least partially flowing over lighting fixtures, the heat of which is dissipated or used [3]
- 3/06 • characterised by the arrangements for the supply of heat-exchange fluid for the subsequent treatment of primary air in the room units (F24F 3/02 takes precedence)
- 3/08 • • with separate supply and return lines for hot and cold heat-exchange fluids
- 3/10 • • with separate supply lines and common return line for hot and cold heat-exchange fluids
- 3/12 • characterised by the treatment of the air otherwise than by heating and cooling (F24F 3/02, F24F 3/06 take precedence; apparatus for the individual treatment, see the appropriate subclasses for the treatments)
- 3/14 • • by humidification; by dehumidification
- 3/147 • • • with both heat and humidity transfer between supplied and exhausted air [3]
- 3/153 • • • with subsequent heating, i.e. with the air, given the required humidity in the central station, passing a heating element to achieve the required temperature [3]
- 3/16 • • by purification, e.g. by filtering; by sterilisation; by ozonisation
- 5/00 Air-conditioning systems or apparatus not covered by group F24F 1/00 or F24F 3/00**
- 
- 6/00 Air-humidification [3]**
- 6/02 • by evaporation of water in the air [3]
- 6/04 • • using stationary unheated wet elements [3]
- 6/06 • • using moving unheated wet elements [3]
- 6/08 • • using heated wet elements [3]
- 6/10 • • • heated electrically [3]
- 6/12 • by forming water dispersions in the air [3]
- 6/14 • • using nozzles (nozzles *per se*, spraying in general B05B) [3]
- 6/16 • • using rotating elements [3]
- 6/18 • by injection of steam into the air [3]
- 7/00 Ventilation**
- 7/007 • with forced flow (using ducting systems F24F 7/06) [3]
- 7/013 • • using wall or window fans, displacing air through the wall or window [3]
- 7/02 • Roof ventilation (F24F 7/007 takes precedence; ventilation of roof coverings E04D) [3, 6]
- 7/04 • with ducting systems
- 7/06 • • with forced air circulation, e.g. by fan
- 7/08 • • • with separate ducts for supplied and exhausted air [3]
- 7/10 • • • with air supply, or exhaust, through perforated wall, floor or ceiling (outlet members for directing or distributing air F24F 13/06) [3]
- 9/00 Use of air currents for screening, e.g. air curtain** (air curtains for vehicles B60J 9/04)
- Common features or details**
- 11/00 Control or safety systems or apparatus** (control valves *per se* F16K) [3]
- 11/02 • Arrangement or mounting of control or safety devices
- 11/04 • • solely for controlling the rate of air-flow (F24F 11/08 takes precedence)
- 11/047 • • • to constant value [3]
- 11/053 • • • by means responsive to temperature [3]

- 11/06 • • solely for controlling the supply of heating or cooling fluids for secondary treatment (F24F 11/08 takes precedence)
- 11/08 • • for controlling the primary treatment of air
- 12/00 Use of energy recovery systems in air conditioning, ventilation or screening** (with both heat and humidity transfer between supplied and exhausted air F24F 3/147; heat-exchange in general F28) [4]
- 13/00 Details common to, or for air-conditioning, air-humidification, ventilation or use of air currents for screening**
- 13/02 • Ducting arrangements
- 13/04 • • Air-mixing units (F24F 13/06 takes precedence; mixing gases in general B01F 3/02)
- 13/06 • • Outlets for directing or distributing air into rooms or spaces, e.g. ceiling air diffuser
- 13/062 • • • having one or more bowls or cones diverging in the flow direction (F24F 13/072 takes precedence) [3]
- 13/065 • • • formed as cylindrical or spherical bodies which are rotatable (F24F 13/072 takes precedence) [3]
- 13/068 • • • formed as perforated walls, ceilings or floors (F24F 13/078 takes precedence) [3]
- 13/072 • • • of elongated shape, e.g. between ceiling panels [3]
- 13/075 • • • having parallel rods or lamellae directing the outflow, e.g. the rods or lamellae being individually adjustable (F24F 13/072 takes precedence) [3]
- 13/078 • • • combined with lighting fixtures (air-treatment systems with air-flow over lighting fixtures F24F 3/056) [3]
- 13/08 • Air-flow control members, e.g. louveres, grilles, flaps, guide plates (F24F 7/013, F24F 13/06 take precedence; roof ventilation F24F 7/02) [3]
- 13/10 • • movable, e.g. damper (F24F 13/18 takes precedence; valves in general F16K)
- 13/12 • • • built-up of sliding members
- 13/14 • • • built-up of tilting members, e.g. louver
- 13/15 • • • • with parallel simultaneously tiltable lamellae [3]
- 13/16 • • • built-up of parallelly-movable plates
- 13/18 • • specially adapted for insertion in flat panels, e.g. in door or window-pane
- 13/20 • Casings or covers [5]
- 13/22 • Means for preventing condensation or evacuating condensate [5]
- 13/24 • Means for preventing or suppressing noise [5]
- 13/26 • Arrangements for air-circulation by means of induction, e.g. by fluid coupling or thermal effect [6]
- 13/28 • Arrangement or mounting of filters [6]
- 13/30 • Arrangement or mounting of heat-exchangers [6]
- 13/32 • Supports for air-conditioning, air-humidification or ventilation units [6]

**F24H FLUID HEATERS, e.g. WATER OR AIR HEATERS, HAVING HEAT-GENERATING MEANS, IN GENERAL** (heat-transfer, heat-exchange or heat-storage materials C09K 5/00; tube furnaces for thermal non-catalytic cracking C10G 9/20; devices, e.g. valves, for venting and aerating enclosures F16K 24/00; steam traps or like apparatus F16T; steam generation F22; combustion apparatus F23; domestic stoves or ranges F24B, F24C; domestic- or space-heating systems F24D; furnaces, kilns, ovens, retorts F27; heat-exchangers F28; electric heating elements or arrangements H05B)

#### Note(s)

- The distinguishing feature of the air heaters covered by this subclass is that the heat is predominantly released to the air by convection, mostly by forced circulation of the air. The domestic stoves or ranges covered by subclass F24B, F24C may also be fired or electric air heaters but they release their heat to a considerable extent by radiation and only to some extent by natural convection.
- In this subclass, the following terms or expressions are used with the meanings indicated:
  - "water" includes other liquids and means always the liquid to be heated;
  - "air" includes other gases or gas mixtures and means always the gas to be heated;
  - "furnace tubes" means tubes inside the heater wherein combustion is performed;
  - "fire tubes" means tubes inside the heater through which flue-gases flow from a combustion chamber located outside the tubes;
  - "heater" means apparatus including both heat generating means and means for transferring the generated heat to water or air.
- All storage heaters are classified in group F24H 7/00.

#### Subclass index

WATER HEATERS.....	1/00
AIR HEATERS; STORAGE HEATERS.....	3/00, 7/00
FLUID HEATERS USING HEAT PUMPS.....	4/00
COMBINATIONS OF WATER AND AIR HEATERS.....	6/00
FLUID HEATERS FOR EXTRACTING LATENT HEAT FROM FLUE GASES.....	8/00
DETAILS.....	9/00

- 1/00 Water heaters having heat generating means, e.g. boiler, flow-heater, water-storage heater** (F24H 7/00, F24H 8/00 take precedence; details F24H 9/00; steam boilers F22B; domestic stoves or ranges with additional provisions for heating water F24B 9/00, F24C 13/00) [5]
- 1/06 • Portable or mobile, e.g. collapsible
- 1/08 • Packaged or self-contained boilers, i.e. water heaters with control devices and pump in a single unit
- 1/10 • Continuous-flow heaters, i.e. heaters in which heat is generated only while the water is flowing, e.g. with direct contact of the water with the heating medium (F24H 1/50 takes precedence) [5]

## F24H

- 1/12 • • in which the water is kept separate from the heating medium
- 1/14 • • • by tubes, e.g. bent in serpentine form
- 1/16 • • • • helically or spirally coiled
- 1/18 • Water-storage heaters (F24H 1/50 takes precedence; combined with water-heating stoves for central heating F24H 1/22) [5]
- 1/20 • • with immersed heating elements, e.g. electric elements or furnace tubes
- 1/22 • Water heaters other than continuous-flow or water-storage heaters, e.g. water heaters for central heating (F24H 1/50 takes precedence) [5]
- 1/24 • • with water mantle surrounding the combustion chamber or chambers (F24H 1/40, F24H 1/44 take precedence) [3]
- 1/26 • • • the water mantle forming an integral body
- 1/28 • • • • including one or more furnace or fire tubes
- 1/30 • • • the water mantle being built-up from sections
- 1/32 • • • • with vertical sections arranged side by side
- 1/34 • • with water chamber arranged adjacent to the combustion chamber or chambers, e.g. above or at side (F24H 1/24, F24H 1/44 take precedence)
- 1/36 • • • the water chamber including one or more fire tubes
- 1/38 • • with water contained in separate elements, e.g. radiator-type element (F24H 1/40, F24H 1/44 take precedence)
- 1/40 • • with water tube or tubes (F24H 1/44 takes precedence)
- 1/41 • • • in serpentine form [3]
- 1/43 • • • helically or spirally coiled [3]
- 1/44 • • with combinations of two or more of the types covered by groups F24H 1/24-F24H 1/40
- 1/46 • Water heaters having plural combustion chambers [2, 5]
- 1/48 • Water heaters for central heating incorporating heaters for domestic water [5]
- 1/50 • • incorporating domestic water tanks [5]
- 1/52 • • incorporating heat exchangers for domestic water (F24H 1/50 takes precedence) [5]
- 3/00 Air heaters having heat generating means** (F24H 7/00, F24H 8/00 take precedence; details F24H 9/00; domestic stoves or ranges with additional provisions for convection heating of air F24B, F24C) [5]
- 3/02 • with forced circulation (F24H 3/12 takes precedence)
- 3/04 • • the air being in direct contact with the heating medium, e.g. electric heating element

- 3/06 • • the air being kept separate from the heating medium, e.g. using forced circulation of air over radiators
- 3/08 • • • by tubes
- 3/10 • • • by plates
- 3/12 • with additional heating arrangements
- 4/00 Fluid heaters using heat pumps [5]**
- 4/02 • Liquid heaters [5]
- 4/04 • • Storage heaters [5]
- 4/06 • Gas heaters [5]
- 6/00 Combined water and air heaters** (F24H 8/00 takes precedence) [5]
- 7/00 Storage heaters, i.e. heaters in which the energy is stored as heat in masses for subsequent release** (domestic stoves or ranges with additional heat storage masses F24B 1/24, F24C 15/34)
- 7/02 • the released heat being conveyed to a transfer fluid, e.g. air, water
- 7/04 • • with forced circulation of the transfer fluid
- 7/06 • the released heat being radiated
- 8/00 Fluid heaters having heat-generating means specially adapted for extracting latent heat from flue gases by means of condensation [5]**
- 9/00 Details**
- 9/02 • Casings; Cover lids; Ornamental panels
- 9/06 • Arrangement of mountings or supports
- 9/12 • Connecting heaters to circulation pipes (pipe joints in general F16L)
- 9/14 • Connecting different sections, e.g. in water heaters (in radiators F28F 9/26)
- 9/16 • Arrangements for water drainage (valves for drainage F16K, e.g. F16K 21/00; in pipes or pipe systems in general F16L 55/00; in domestic-or space-heating systems F24D 19/08)
- 9/18 • Arrangement or mounting of grates, burners, or heating elements (burners F23D; grates F23H; electric heating elements H05B)
- 9/20 • Arrangement or mounting of control or safety devices (control valves F16K; safety devices for burners F23D; combustion control devices F23N; of systems comprising a heater, see the relevant subclasses, e.g. of control heating systems F24D 19/10; automatic switching for electric heating apparatus H05B 1/02)

## F24J PRODUCTION OR USE OF HEAT NOT OTHERWISE PROVIDED FOR (materials therefor C09K 5/00; engines or other mechanisms for producing mechanical power from heat, see the relevant classes, e.g. F03G for using natural heat)

- 1/00 Apparatus or devices using heat produced by exothermal chemical reactions other than by combustion** (for cooking-vessels A47J 36/28; self-heating compresses A61F 7/03; materials for the production of heat or cold undergoing non-reversible chemical reactions, other than by combustion, when used C09K 5/18)

- 2/00 Use of solar heat, e.g. solar heat collectors** (distillation or evaporation of water using solar energy C02F 1/14; roof covering aspects of energy collecting devices E04D 13/18; devices for producing mechanical power from solar energy F03G 6/00; semi-conductor devices specially adapted for converting solar energy into electrical energy H01L 25/00, H01L 31/00; semiconductor devices including arrays of solar cells using heat energy H01L 31/058; generators in which light radiation is directly converted into electrical energy H02N 6/00) [4, 5]
- 2/02 • Solar heat collectors with support for article heated, e.g. stoves, ranges, crucibles, furnaces or ovens using solar heat [4]

- |  |   |
|--|---|
| <p>2/04 • Solar heat collectors having working fluid conveyed through collector [4]</p> <p>2/05 • • surrounded by a transparent enclosure, e.g. evacuated solar collectors [6]</p> <p>2/06 • • having concentrating elements (optical elements or systems <u>per se</u> G02B) [4]</p> <p>2/07 • • • Receivers working at high temperature, e.g. for solar power plants [6]</p> <p>2/08 • • • having lenses as concentrating elements [4]</p> <p>2/10 • • • having reflectors as concentrating elements [4]</p> <p>2/12 • • • • parabolic [4]</p> <p>2/13 • • • • hemispherical [6]</p> <p>2/14 • • • • semi-cylindrical or cylindro-parabolic [4]</p> <p>2/15 • • • • conical [6]</p> <p>2/16 • • • • having flat plates [4]</p> <p>2/18 • • • • spaced, opposed interacting reflecting surfaces [4]</p> <p>2/20 • • • the working fluid being conveyed between plates [4]</p> <p>2/22 • • • having extended surfaces, e.g. protrusions, corrugations (F24J 2/28 takes precedence) [4]</p> <p>2/23 • • • the working fluid trickling freely over collector elements [6]</p> <p>2/24 • • • the working fluid being conveyed through tubular heat absorbing conduits [4]</p> <p>2/26 • • • having extended surfaces, e.g. protrusions (F24J 2/28 takes precedence) [4]</p> <p>2/28 • • • having permeable mass, foraminous or porous materials [4]</p> | <p>2/30 • • with means to exchange heat between plural fluids [4]</p> <p>2/32 • • having evaporator and condenser section, e.g. heat pipe [4]</p> <p>2/34 • • having heat storage mass [4]</p> <p>2/36 • Rollable or foldable collector units [4]</p> <p>2/38 • employing tracking means (F24J 2/02, F24J 2/06 take precedence; rotary supports or mountings therefor F24J 2/54; direction-finders for determining the direction from which electromagnetic waves are being received G01S 3/78; control of position or direction G05D 3/00) [4]</p> <p>2/40 • Control arrangements [4]</p> <p>2/42 • Solar heat systems not otherwise provided for [4]</p> <p>2/44 • • having thermosiphonic circulation [4]</p> <p>2/46 • Component parts, details or accessories of solar heat collectors [4]</p> <p>2/48 • • characterised by the absorber material [4]</p> <p>2/50 • • Transparent coverings [4]</p> <p>2/51 • • Thermal insulation (F24J 2/50 takes precedence) [6]</p> <p>2/52 • • Arrangement of mountings or supports [4]</p> <p>2/54 • • • specially adapted for rotary movement [6]</p> <p><b>3/00 Other production or use of heat, not derived from combustion</b> (use of solar heat F24J 2/00)</p> <p>3/06 • using natural heat [4]</p> <p>3/08 • • using geothermal heat (devices for producing mechanical power from geothermal energy F03G 4/00) [4, 5]</p> |
|--|---|

## F25 REFRIGERATION OR COOLING; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS; MANUFACTURE OR STORAGE OF ICE; LIQUEFACTION OR SOLIDIFICATION OF GASES

**F25B REFRIGERATION MACHINES, PLANTS, OR SYSTEMS; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS** (heat-transfer, heat-exchange or heat-storage materials, e.g. refrigerants, or materials for the production of heat or cold by chemical reactions other than by combustion C09K 5/00; pumps, compressors F04; use of heat pumps for domestic or space-heating or for domestic hot-water supply F24D; air-conditioning, air-humidification F24F; fluid heaters using heat pumps F24H)

### Note(s)

Attention is drawn to Note (2) following the title of subclass F24F.

### Subclass index

#### MODE OF OPERATION

##### Compression type

- |   |                        |
|---|------------------------|
| characterised by the cycle.....   | 1/00, 13/00            |
| characterised by the arrangement  |                        |
| self-contained rotary; with several evaporation circuits; with several condenser circuits; with cascade operation.....              | 3/00, 5/00, 6/00, 7/00 |
| characterised by the refrigerant.....   | 9/00                   |
| using turbines.....   | 11/00                  |
| Sorption type.....  | 15/00, 17/00           |
| Other types having a single mode of operation, using: evaporation without recovery; electric or magnetic effects; other effect..... | 19/00, 21/00, 23/00    |
| Combinations: of above modes of operation; of heating and refrigerating.....  | 25/00, 29/00           |
| Heat pumps.....   | 30/00                  |
| Using special energy source.....  | 27/00                  |

#### DETAILS, ARRANGEMENTS, OR COMPONENTS

- |  |                                   |
|--|-----------------------------------|
| Components: boilers, analysers, rectifiers; boiler-absorbers; absorbers, adsorbers; evaporators, condensers; subcoolers, desuper- heaters, superheaters..... | 33/00, 35/00, 37/00, 39/00, 40/00 |
|--|-----------------------------------|

## Arrangements

- compressor arrangement; fluid circulation; separating or purifying gases.....31/00, 41/00, 43/00  
 for charging or discharging refrigerant; for combating corrosion or deposits.....45/00, 47/00  
 Mounting of control and safety devices.....49/00

**Compression machines, plant, or systems**

- 1/00 Compression machines, plant or systems with non-reversible cycle** (F25B 3/00, F25B 5/00, F25B 6/00, F25B 7/00, F25B 9/00 take precedence) [5]
- 1/02 • with compressor of reciprocating-piston type (F25B 1/10 takes precedence)
- 1/04 • with compressor of rotary type (F25B 1/10 takes precedence)
- 1/047 • • of screw type [5]
- 1/053 • • of turbine type [5]
- 1/06 • with compressor of jet type, e.g. using liquid under pressure (F25B 1/10 takes precedence)
- 1/08 • • using vapour under pressure
- 1/10 • with multi-stage compression (with cascade operation F25B 7/00)
- 3/00 Self-contained rotary compression machines, i.e. with compressor, condenser, and evaporator rotating as a single unit**
- 5/00 Compression machines, plant, or systems, with several evaporator circuits, e.g. for varying refrigerating capacity** (with cascade operation F25B 7/00)
- 5/02 • arranged in parallel [5]
- 5/04 • arranged in series [5]
- 6/00 Compression machines, plant, or systems, with several condenser circuits** [5]
- 6/02 • arranged in parallel [5]
- 6/04 • arranged in series [5]
- 7/00 Compression machines, plant, or systems, with cascade operation, i.e. with two or more circuits, the heat from the condenser of one circuit being absorbed by the evaporator of the next circuit** (F25B 9/00 takes precedence)
- 9/00 Compression machines, plant, or systems, in which the refrigerant is air or other gas of low boiling point**
- 9/02 • using Joule-Thompson effect; using vortex effect
- 9/04 • • using vortex effect [5]
- 9/06 • using expanders (F25B 9/10 takes precedence) [5]
- 9/08 • using ejectors (F25B 9/10 takes precedence) [5]
- 9/10 • with several cooling stages [5]
- 9/12 • using 3He-4He dilution [5]
- 9/14 • characterised by the cycle used, e.g. Stirling cycle [5]
- 11/00 Compression machines, plant, or systems, using turbines, e.g. gas turbines**
- 11/02 • as expanders (F25B 9/06 takes precedence) [5]
- 11/04 • • centrifugal type [5]
- 13/00 Compression machines, plant, or systems, with reversible cycle** (defrosting cycles F25B 47/02)

**Sorption machines, plant, or systems**

- 15/00 Sorption machines, plant, or systems, operating continuously, e.g. absorption type**
- 15/02 • without inert gas (F25B 15/12, F25B 15/14, F25B 15/16 take precedence)
- 15/04 • • the refrigerant being ammonia evaporated from aqueous solution
- 15/06 • • the refrigerant being water vapour evaporated from a salt solution, e.g. lithium bromide
- 15/08 • • the refrigerant being sulfuric acid
- 15/09 • • the refrigerant being hydrogen desorbed from a hydride [5]
- 15/10 • with inert gas (F25B 15/12, F25B 15/14, F25B 15/16 take precedence)
- 15/12 • with resorber (F25B 15/14 takes precedence)
- 15/14 • using osmosis
- 15/16 • using desorption cycle
- 17/00 Sorption machines, plant, or systems, operating intermittently, e.g. absorption or adsorption type**
- 17/02 • the absorbent or adsorbent being a liquid, e.g. brine (F25B 17/10 takes precedence)
- 17/04 • • with two or more boilers operating alternately
- 17/06 • • with the boiler and evaporator built-up as a unit in a tiltable or revolving arrangement
- 17/08 • the absorbent or adsorbent being a solid, e.g. salt (F25B 17/12 takes precedence) [5]
- 17/10 • using the endothermic solution of salt
- 17/12 • using desorption of hydrogen from a hydride [5]

**Machines, plant, or systems, with a single mode of operation, not covered by groups F25B 1/00-F25B 17/00**

- 19/00 Machines, plant, or systems, using evaporation of a refrigerant but without recovery of the vapour**
- 19/02 • using fluid jet, e.g. of steam
- 19/04 • • using liquid jet, e.g. of water
- 21/00 Machines, plant, or systems, using electric or magnetic effects**
- 21/02 • using Peltier effect; using Nernst-Ettinghausen effect (thermoelectric elements H01L 35/00, H01L 37/00)
- 21/04 • • reversible [5]
- 23/00 Machines, plant, or systems, with a single mode of operation not covered by groups F25B 1/00-F25B 21/00, e.g. using selective radiation effect**
- 
- 25/00 Machines, plant, or systems, using a combination of modes of operation covered by two or more of the groups F25B 1/00-F25B 23/00** (combinations of two or more modes of operation covered by a single main group, *see* the relevant group)
- 25/02 • Compression-sorption machines, plants, or systems

- 27/00 Machines, plant, or systems, using particular sources of energy** (F25B 30/06 takes precedence)
- 27/02 • using waste heat, e.g. from internal-combustion engines
- 29/00 Combined heating and refrigeration systems, e.g. operating alternately or simultaneously** [5]
- 30/00 Heat pumps** [5]
- Note(s)**  
When classifying heat pump circuits or systems, groups F25B 1/00-F25B 25/00 and F25B 29/00 take precedence over group F25B 30/00.
- 30/02 • of the compression type [5]
- 30/04 • of the sorption type [5]
- 30/06 • characterised by the source of low potential heat [5]
- Component parts or details**
- 31/00 Compressor arrangements** (compressors *per se* F04)
- 31/02 • of motor-compressor units
- 33/00 Boilers; Analysers; Rectifiers** (boiler-absorbers F25B 35/00)
- 35/00 Boiler-absorbers, i.e. boilers usable for absorption or adsorption**
- 35/02 • using a liquid as sorbent, e.g. brine
- 35/04 • using a solid as sorbent
- 37/00 Absorbers; Adsorbers** (boiler-absorbers F25B 35/00; separating processes involving the treatment of liquids with solid sorbents B01D 15/00; separation of gases or vapours by adsorption B01D 53/02; separation of gases or vapours by absorption B01D 53/14; investigating using adsorption or absorption G01N 30/00)
- F25C PRODUCTION, WORKING, STORING OR DISTRIBUTION OF ICE** (frozen sweets, including ice-cream, their production A23G 9/00; concentrating solutions by removing frozen solvents B01D 9/04; purification of water by freezing C02F 1/22; refrigeration machines, plants, or systems F25B; solidification of gases or gaseous mixtures F25J; freeze-drying F26B) [2]
- 39/00 Evaporators; Condensers**
- 39/02 • Evaporators
- 39/04 • Condensers
- 40/00 Subcoolers, desuperheaters or superheaters** [5]
- 40/02 • Subcoolers [5]
- 40/04 • Desuperheaters [5]
- 40/06 • Superheaters [5]
- 41/00 Fluid-circulation arrangements, e.g. for transferring liquid from evaporator to boiler** (pumps *per se*, sealings therefor F04)
- 41/02 • using electro-osmosis
- 41/04 • Disposition of valves (valves *per se* F16K)
- 41/06 • Flow restrictors, e.g. capillary tubes; Disposition thereof
- 43/00 Arrangements for separating or purifying gases or liquids** (in analysers or rectifiers F25B 33/00); **Arrangements for vaporising the residuum of liquid refrigerant, e.g. by heat** (F25B 40/00 takes precedence) [5]
- 43/02 • for separating lubricants from the refrigerant
- 43/04 • for withdrawing non-condensable gases
- 45/00 Arrangements for charging or discharging refrigerant**
- 47/00 Arrangements for preventing or removing deposits or corrosion, not provided for in another subclass**
- 47/02 • Defrosting cycles [5]
- 49/00 Arrangement or mounting of control or safety devices** (testing refrigerators G01M; control in general G05)
- 49/02 • for compression type machines, plant or systems [5]
- 49/04 • for sorption type machines, plant or systems [5]

**Note(s)**

In this subclass, the following term is used with the meaning indicated:

- "ice" means any frozen liquid and also covers frozen semiliquids or pasty substances.

- 1/00 Production of ice** (F25C 3/00 takes precedence)
- 1/02 • Production of natural ice, i.e. without refrigeration
- 1/04 • by using stationary moulds
- 1/06 • • open or openable at both ends
- 1/08 • by immersing freezing chambers or plates into water
- 1/10 • by using rotating or otherwise moving moulds (F25C 1/08 takes precedence)
- 1/12 • by freezing water on cooled surfaces, e.g. to form slabs
- 1/14 • • to form thin sheets which are removed by scraping or wedging, e.g. in the form of flakes
- 1/16 • by partially evaporating water in a vacuum
- 1/18 • of a particular transparency or translucency, e.g. by injecting air
- 1/20 • • by agitation
- 1/22 • Construction of moulds; Filling devices therefor (metering by volume in general G01F)
- 1/24 • • for refrigerators, e.g. freezing trays
- 3/00 Methods or apparatus specially adapted for the production of ice or snow for winter sports or similar recreational purposes, e.g. for sporting installations; Production of artificial snow** (foundations or pavings for artificial surfaces for outdoor or indoor practice of snow or ice sports E01C 13/10; working on surfaces of snow or ice in order to make them suitable for traffic or sporting purposes E01H 4/00)
- 3/02 • for ice rinks
- 3/04 • for sledging trails or ski trails; Production of artificial snow
- 5/00 Working, storing or distribution of ice**
- 5/02 • Tools or machines for disintegrating, removing, or harvesting ice
- 5/04 • • without the use of saws
- 5/06 • • • by deforming bodies with which the ice is in contact, e.g. by inflatable members
- 5/08 • • • by heating bodies in contact with the ice

## F25C

- 5/10 • • • • using hot refrigerant; using fluid heated by refrigerant
- 5/12 • • • Ice-shaving machines
- 5/14 • Tools or machines for shaping or finishing ice pieces, e.g. ice presses
- 5/16 • Tools or devices for ice handling not covered by any other subclass
- 5/18 • Storing ice

**F25D REFRIGERATORS; COLD ROOMS; ICE-BOXES; COOLING OR FREEZING APPARATUS NOT COVERED BY ANY OTHER SUBCLASS** (refrigerated showcases A47F 3/04; thermally-insulated vessels for domestic use A47J 41/00; refrigerated vehicles, see the appropriate subclasses of classes B60-B64; containers with thermal insulation in general B65D 81/38; heat-transfer, heat-exchange or heat-storage materials, e.g. refrigerants, or materials for the production of heat or cold by chemical reactions other than by combustion C09K 5/00; thermally-insulated vessels for liquefied or solidified gases F17C; air-conditioning or air-humidification F24F; refrigeration machines, plants, or systems F25B; cooling of instruments or comparable apparatus without refrigeration G12B; cooling of engines or pumps, see the relevant classes)

### Note(s)

1. Devices associated with refrigerating machinery are classified in groups F25D 11/00-F25D 16/00.
2. In this subclass, the following term is used with the meaning indicated:
  - "device" means an enclosed space to be cooled; such devices being associated either with refrigerating machinery, e.g. in a refrigerator, or with other cold sources, e.g. in an ice-box.
3. Attention is drawn to Note (2) following the title of subclass F24F.

### Subclass index

#### DEVICES NOT ASSOCIATED WITH REFRIGERATING MACHINERY

- Using cold air or water; other cold materials or bodies.....1/00, 3/00
- Using endothermic chemical reactions, or evaporation without recovery.....5/00, 7/00
- Other devices, combinations.....9/00

#### DEVICES ASSOCIATED WITH REFRIGERATING MACHINERY: SELF-CONTAINED MOVABLE;

STATIONARY; OTHER.....11/00, 13/00, 15/00

In combination with a cooling mode not associated with refrigerating machinery.....16/00

#### STRUCTURAL PARTS OR ARRANGEMENTS, OF GENERAL APPLICATION: DEFROSTING;

GENERAL FEATURES; HANDLING OF ARTICLES TO BE COOLED.....21/00, 23/00, 25/00

CIRCULATING COOLING FLUID OR GAS; LIGHTING.....17/00, 27/00

#### ARRANGEMENT OR MOUNTING: OF REFRIGERATION UNITS; OF CONTROL OR SAFETY

DEVICES.....19/00, 29/00

OTHER APPARATUS.....31/00

### Devices not associated with refrigerating machinery

- 1/00 Devices using naturally-cold air or water**  
1/02 • using naturally-cold water, e.g. household-tap water

**3/00 Devices using other cold materials; Devices using cold-storage bodies**

- 3/02 • using ice, e.g. ice-boxes
- 3/04 • • Stationary cabinets
- 3/06 • • Movable containers
- 3/08 • • • portable, i.e. adapted to be carried personally
- 3/10 • using liquefied gases, e.g. liquid air
- 3/11 • • with conveyers carrying articles to be cooled through the cooling space [4]
- 3/12 • using solidified gases, e.g. carbon-dioxide snow
- 3/14 • • portable, i.e. adapted to be carried personally

**5/00 Devices using endothermic chemical reactions, e.g. using frigorific mixtures**

- 5/02 • portable, i.e. adapted to be carried personally

**7/00 Devices using evaporation effects without recovery of the vapour** (butter or cheese dishes with cooling devices A47G 19/26)

- 9/00 Devices not associated with refrigerating machinery and not covered by groups F25D 1/00-F25D 7/00; Combinations of devices covered by two or more of the groups F25D 1/00-F25D 7/00**

### Devices associated with refrigerating machinery

**11/00 Self-contained movable devices associated with refrigerating machinery, e.g. domestic refrigerators**

- 11/02 • with cooling compartments at different temperatures
- 11/04 • specially adapted for storing deep-frozen articles (F25D 11/02 takes precedence)

**13/00 Stationary devices associated with refrigerating machinery, e.g. cold rooms**

- 13/02 • with several cooling compartments, e.g. refrigerated locker systems
- 13/04 • • the compartments being at different temperatures
- 13/06 • with conveyers carrying articles to be cooled through the cooling space

**15/00 Devices associated with refrigerating machinery not covered by group F25D 11/00 or F25D 13/00, e.g. non-self-contained movable devices**

**16/00** Devices using a combination of a cooling mode associated with refrigerating machinery with a cooling mode not associated with refrigerating machinery [5]

**Details or features of the devices covered by groups F25D 1/00-F25D 16/00 [5]**

**17/00** Arrangements for circulating cooling fluids; Arrangements for circulating gas, e.g. air, within refrigerated spaces [3]

- 17/02 • for circulating liquids, e.g. brine
- 17/04 • for circulating gas, e.g. by natural convection [3]
- 17/06 • • by forced circulation
- 17/08 • • • using ducts

**19/00** Arrangement or mounting of refrigeration units with respect to devices

- 19/02 • plug-in type
- 19/04 • with more than one refrigeration unit

**21/00** Defrosting; Preventing frosting; Removing condensed or defrost water (removing ice or water from heat-exchange apparatus in general F28F 17/00; heating arrangements specially adapted for transparent or reflecting areas H05B 3/84)

- 21/02 • Detecting the presence of frost or condensate
- 21/04 • Preventing the formation of frost or condensate
- 21/06 • Removing frost (defrosting cycles F25B 47/02)
- 21/08 • • by electric heating
- 21/10 • • by spraying with fluid

**F25J LIQUEFACTION, SOLIDIFICATION, OR SEPARATION OF GASES OR GASEOUS MIXTURES BY PRESSURE AND COLD TREATMENT** (cryogenic pumps F04B 37/08; gas storage vessels, gas-holders F17; filling vessels with, or discharging from vessels, compressed, liquefied, or solidified gases F17C; refrigeration machines, plants, or systems F25B)

**1/00** Processes or apparatus for liquefying or solidifying gases or gaseous mixtures

- 1/02 • requiring the use of refrigeration, e.g. of helium or hydrogen

**3/00** Processes or apparatus for separating the constituents of gaseous mixtures involving the use of liquefaction or solidification

- 3/02 • by rectification, i.e. by continuous interchange of heat and material between a vapour stream and a liquid stream (F25J 3/08 takes precedence)

- 21/12 • • by hot-fluid circulating system separate from the refrigerant system

- 21/14 • Collecting or removing condensed and defrost water; Drip trays

**23/00** General constructional features (F25D 21/00 takes precedence)

- 23/02 • Doors; Covers (F25D 23/08 takes precedence)
- 23/04 • • with special compartments, e.g. butter conditioners
- 23/06 • Walls (F25D 23/08 takes precedence; containers with thermal insulation B65D 81/38) [4]
- 23/08 • Parts formed wholly or mainly of plastics materials
- 23/10 • Arrangements for mounting in particular locations, e.g. for built-in type, for corner type
- 23/12 • Arrangements of compartments additional to cooling compartments; Combinations of refrigerators with other equipment, e.g. stove

**25/00** Charging, supporting, or discharging the articles to be cooled

- 25/02 • by shelves
- 25/04 • by conveyers (in general B65G)

**27/00** Lighting arrangements (in general F21)

**29/00** Arrangement or mounting of control or safety devices

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**31/00** Other cooling or freezing apparatus

**F26 DRYING**

**F26B DRYING SOLID MATERIALS OR OBJECTS BY REMOVING LIQUID THEREFROM** (drying devices for combines A01D 41/133; racks for drying fruit or vegetables A01F 25/12; drying foodstuffs A23; drying hair A45D 20/00; body-drying implements A47K 10/00; drying household articles A47L; drying gases or vapours B01D; chemical or physical processes for dewatering or like separating liquids from solids B01D 43/00; centrifugal apparatus B04; drying ceramics C04B 33/30; drying yarns or fabrics in association with some other form of treatment D06C; drying frames for laundry without heating or positive air circulation, domestic laundry-or spin-driers, wringing or hot pressing laundry D06F; furnaces, kilns, ovens F27)

**Subclass index**

PROCESSES FOR DRYING

- Preliminary treatment.....1/00
- Processes: with heat; without heat; by combination of both types.....3/00, 5/00, 7/00

## MACHINES OR APPARATUS FOR DRYING

With articles to be dried at rest or locally agitated, domestic airing.....	9/00
With non-progressive movement.....	11/00
With progressive movement: for fabrics or yarns; for articles and compact batches; for material not in compact batches.....	13/00, 15/00, 17/00
Other kinds.....	19/00
Combinations using at least two of the above kinds.....	20/00

## ARRANGEMENTS OR DETAILS OF GENERAL APPLICATIONS

Arrangements for air or gas for drying; heating.....	21/00, 23/00
Other details.....	25/00

**Processes for drying**

- 1/00 Preliminary treatment of solid materials or objects to facilitate drying**
- 3/00 Drying solid materials or objects by processes involving the application of heat** (in specific machines or apparatus F26B 9/00-F26B 19/00)
- 3/02 • by convection, i.e. heat being conveyed from a heat source to the materials or objects to be dried by a gas or vapour, e.g. air
- 3/04 • • the gas or vapour circulating over, or surrounding, the materials or objects to be dried (F26B 3/14 takes precedence)
- 3/06 • • the gas or vapour flowing through the materials or objects to be dried (F26B 3/14 takes precedence)
- 3/08 • • • so as to loosen them, e.g. to form a fluidised bed
- 3/084 • • • with heat exchange taking place in the fluidised bed [5]
- 3/088 • • • using inert thermally-stabilised particles [5]
- 3/092 • • • agitating the fluidised bed, e.g. by vibrating or pulsating [5]
- 3/097 • • • using a magnetic field to stabilise the fluidised bed [5]
- 3/10 • • the gas or vapour carrying the materials or objects to be dried with it
- 3/12 • • • in the form of a spray
- 3/14 • • the materials or objects to be dried being moved by gravity
- 3/16 • • • in a counter-flow of the gas or vapour
- 3/18 • by conduction, i.e. the heat is conveyed from the heat source, e.g. gas flame, to the materials or objects to be dried by direct contact
- 3/20 • • the heat source being a heated surface (F26B 3/22 takes precedence)
- 3/22 • • the heat source and the materials or objects to be dried being in relative motion, e.g. of vibration
- 3/24 • • • the movement being rotation
- 3/26 • • • the movement being performed by gravity
- 3/28 • by radiation, e.g. from the sun
- 3/30 • • from infra-red-emitting elements
- 3/32 • by development of heat within the materials or objects to be dried
- 3/34 • • by using electrical effects
- 3/347 • • • Electromagnetic heating, e.g. induction heating or heating using microwave energy [4]
- 3/353 • • • Resistance heating [4]
- 3/36 • • by using mechanical effects, e.g. by friction (by using ultrasonic vibration F26B 5/02)

- 5/00 Drying solid materials or objects by processes not involving the application of heat** (separating liquids from solids by straining B01D; replacing liquids in wet solids by other liquids, e.g. water by spirit, B01D 12/00; drying by electrophoresis B01J)
- 5/02 • by using ultrasonic vibrations
- 5/04 • by evaporation or sublimation of moisture under reduced pressure, e.g. in a vacuum
- 5/06 • • the process involving freezing
- 5/08 • by centrifugal treatment
- 5/10 • • the process involving freezing
- 5/12 • by suction
- 5/14 • by applying pressure, e.g. wringing; by brushing; by wiping
- 5/16 • by contact with sorbent bodies, e.g. absorbent mould; by admixture with sorbent materials
- 7/00 Drying solid materials or objects by processes using a combination of processes not covered by a single one of groups F26B 3/00 or F26B 5/00**

**Machines or apparatus for drying**

- 9/00 Machines or apparatus for drying solid materials or objects at rest or with only local agitation; Domestic airing cupboards**
- 9/02 • in buildings (special types of buildings E04H)
- 9/04 • in presses or clamping devices
- 9/06 • in stationary drums or chambers
- 9/08 • • including agitating devices
- 9/10 • in the open air; in pans or tables in rooms; Drying stacks of loose material
- 11/00 Machines or apparatus for drying solid materials or objects with movement which is non-progressive**
- 11/02 • in moving drums or other mainly-closed receptacles (F26B 11/18 takes precedence)
- 11/04 • • rotating about a horizontal or slightly-inclined axis
- 11/06 • • • with stirring devices which are held stationary
- 11/08 • • rotating about a vertical or steeply-inclined axis
- 11/10 • • • with stirring devices which are held stationary
- 11/12 • in stationary drums or other mainly-closed receptacles with moving stirring devices (F26B 11/22 takes precedence)
- 11/14 • • the stirring device moving in a horizontal or slightly-inclined plane
- 11/16 • • the stirring device moving in a vertical or steeply-inclined plane
- 11/18 • on or in moving dishes, trays, pans, or other mainly-open receptacles
- 11/20 • • with stirring devices which are held stationary

- 11/22 • on or in stationary dishes, trays, pans, or other mainly-open receptacles, with moving stirring devices
- 13/00 Machines or apparatus for drying fabrics, fibres, yarns, or other materials in long lengths, with progressive movement**
- 13/02 • with movement in a straight line
- 13/04 • • using rollers
- 13/06 • with movement in a sinuous or zig-zag path
- 13/08 • • using rollers
- 13/10 • Arrangements for feeding, heating, or supporting materials; Regulating movement, tension, or position of materials (heating processes F26B 3/00)
- 13/12 • • Regulating movement, tension, or position of material
- 13/14 • • Rollers (sorberent surfaces F26B 13/26)
- 13/16 • • • perforated (F26B 13/18 takes precedence; for applying suction F26B 13/30)
- 13/18 • • • heated; cooled
- 13/20 • • Supporting materials by fluid jets, e.g. air
- 13/22 • • Arrangements of gas flames
- 13/24 • Arrangements of devices using drying processes not involving heating (such processes *per se* F26B 5/00)
- 13/26 • • using sorberent surfaces, e.g. bands or coverings on rollers
- 13/28 • • for applying pressure; for brushing; for wiping
- 13/30 • • for applying suction, e.g. through perforated rollers
- 15/00 Machines or apparatus for drying objects with progressive movement; Machines or apparatus with progressive movement for drying batches of material in compact form** (F26B 13/00, F26B 17/00 take precedence; conveyers in general B65G)
- 15/02 • with movement in the whole or part of a circle
- 15/04 • • in a horizontal plane
- 15/06 • • • involving several planes, one above the other
- 15/08 • • in a vertical plane
- 15/10 • with movement in a path composed of one or more straight lines, e.g. compound
- 15/12 • • the lines being all horizontal or slightly inclined
- 15/14 • • • the objects or batches of materials being carried by trays or racks
- 15/16 • • • the objects or batches of materials being carried by wheeled trucks
- 15/18 • • • the objects or batches of materials being carried by endless belts
- 15/20 • • the lines being all vertical or steeply inclined
- 15/22 • • • the objects or batches of materials being carried by endless belts
- 15/24 • • • • in a zig-zag path
- 15/26 • with movement in a helical path
- 17/00 Machines or apparatus for drying materials in loose, plastic, or fluidised form, e.g. granules, staple fibres, with progressive movement** (F26B 13/00 takes precedence)
- 17/02 • with movement performed by belts carrying the materials; with movement performed by belts propelling the materials over stationary surfaces
- 17/04 • • the belts being all horizontal or slightly inclined (F26B 17/08 takes precedence)
- 17/06 • • the belts being all vertical or steeply inclined (F26B 17/08 takes precedence)
- 17/08 • • the belts being arranged in a sinuous or zig-zag path
- 17/10 • with movement performed by fluid currents, e.g. issuing from a nozzle (F26B 3/08 takes precedence) [5]
- 17/12 • with movement performed solely by gravity
- 17/14 • • the materials moving through a counter-current of gas
- 17/16 • • the materials passing down a heated surface
- 17/18 • with movement performed by rotating helical blades or other rotary conveyers moving materials in stationary chambers
- 17/20 • • the axis of rotation being horizontal or slightly inclined
- 17/22 • • the axis of rotation being vertical or steeply inclined
- 17/24 • with movement performed by shooting or throwing the materials
- 17/26 • with movement performed by reciprocating or oscillating conveyers propelling materials over stationary surfaces; with movement performed by reciprocating or oscillating shelves, sieves, or trays
- 17/28 • with movement performed by rollers or discs with material passing over or between them, e.g. suction drum, sieve
- 17/30 • with movement performed by rotary or oscillating containers; with movement performed by rotary floors
- 17/32 • • the movement being in a horizontal or slightly-inclined plane
- 17/34 • • the movement being in a vertical or steeply-inclined plane
- 19/00 Machines or apparatus for drying solid materials or objects not covered by groups F26B 9/00-F26B 17/00**
- 20/00 Combinations of machines or apparatus covered by two or more of groups F26B 9/00-F26B 19/00**
- Details of general application**
- 21/00 Arrangements for supplying or controlling air or gases for drying solid materials or objects** (air-conditioning or ventilation in general F24F)
- 21/02 • Circulating air or gases in closed cycles, e.g. wholly within the drying enclosure (F26B 21/14 takes precedence)
- 21/04 • • partly outside the drying enclosure
- 21/06 • Controlling, e.g. regulating, parameters of gas supply (F26B 21/14 takes precedence)
- 21/08 • • Humidity
- 21/10 • • Temperature; Pressure
- 21/12 • • Velocity of flow; Quantity of flow
- 21/14 • using gases or vapours other than air or steam
- 23/00 Heating arrangements** (using heated air or gases F26B 21/00)
- 23/02 • using combustion heating (F26B 23/10 takes precedence)
- 23/04 • using electric heating (F26B 23/10 takes precedence)
- 23/06 • • resistance heating
- 23/08 • • inductive heating; capacitative heating; microwave heating
- 23/10 • using tubes or passages containing heated fluids
- 25/00 Details of general application not covered by group F26B 21/00 or F26B 23/00** (loading, conveying, or unloading in general B65G)

## F26B

- |       |   |       |  |
|-------|---|-------|--|
| 25/02 | • Applications of driving mechanisms, not covered by another subclass | 25/14 | • • Chambers, containers, receptacles of simple construction                                   |
| 25/04 | • Agitating, stirring, or scraping devices                            | 25/16 | • • • mainly closed, e.g. drum   |
| 25/06 | • Chambers, containers, or receptacles                                | 25/18 | • • • mainly open, e.g. dish, tray, pan  |
| 25/08 | • • Parts thereof   | 25/20 | • Rollers (F26B 25/06 takes precedence)  |
| 25/10 | • • • Floors, roofs, or bottoms; False bottoms                        | 25/22 | • Controlling the drying process in dependence on liquid content of solid materials or objects |
| 25/12 | • • • Walls or sides; Doors   |       |  |

## F27 FURNACES; KILNS; OVENS; RETORTS

### Note(s)

1. This class covers:
  - furnaces, kilns, ovens, retorts, open sintering apparatus and other similar apparatus for heat treatment of materials or articles, and details or accessories therefor, in general;
  - the arrangement of electrical heating elements in or on furnaces.
2. This class does not cover:
  - combustion apparatus per se, i.e. apparatus for direct combination of oxygen gas and a burnable substance;
  - electrical heating elements per se;
  - processes carried on within the furnaces.
3. In this class, the following term is used with the meaning indicated:
  - "furnaces" covers kilns, ovens, or retorts.

**F27B FURNACES, KILNS, OVENS, OR RETORTS IN GENERAL; OPEN SINTERING OR LIKE APPARATUS** (combustion apparatus F23; electric heating H05B)

### Note(s)

Attention is drawn to the references and Notes following the title of class F27 and the Note (3) of section H.

### Subclass index

FURNACES WITH STATIONARY CHARGE	
Shaft furnaces.....	1/00
Horizontal furnaces.....	3/00, 5/00
Bell-type furnaces.....	11/00
With progression of heating.....	13/00
Crucible furnaces, tank furnaces.....	14/00
STATIONARY FURNACES WITH MECHANICALLY-MOVED CHARGE.....	9/00
ROTARY FURNACES.....	7/00, 13/00
OTHER FURNACES; COMBINATIONS.....	15/00, 17/00, 19/00
OPEN SINTERING OR LIKE APPARATUS.....	21/00

- 
- |  |             |   |
|--|-------------|---|
| <b>1/00 Shaft or like vertical or substantially vertical furnaces</b> (for preheating, burning, calcining or cooling lime, magnesia or dolomite C04B 2/12) | 1/22        | • • Arrangements of heat-exchange apparatus (heat-exchangers in general F28C, F28D)   |
| 1/02 • with two or more shafts or chambers, e.g. multi-storey  | 1/24        | • • Cooling arrangements  |
| 1/04 • • Combinations or arrangements of shafts  | 1/26        | • • Arrangements of controlling devices   |
| 1/06 • of other than up-draught type   | 1/28        | • • Arrangements of monitoring devices, of indicators, of alarm devices   |
| 1/08 • heated otherwise than by solid fuel mixed with charge   | <b>3/00</b> | <b>Hearth-type furnaces, e.g. of reverberatory type</b> (F27B 9/00-F27B 15/00, F27B 21/00 take precedence);<br><b>Electric arc furnaces [4]</b> |
| 1/09 • • heated electrically [4]   | 3/02        | • of single-chamber fixed-hearth type   |
| 1/10 • Details, accessories, or equipment peculiar to furnaces of these types  | 3/04        | • of multiple-hearth type; of multiple-chamber type; Combinations of hearth-type furnaces   |
| 1/12 • • Shells or casings; Supports therefor  | 3/06        | • with movable working chambers or hearths, e.g. tiltable   |
| 1/14 • • • Arrangements of linings (linings in general F27D 1/00)  | 3/08        | • heated electrically, e.g. electric arc furnaces, with or without any other source of heat   |
| 1/16 • • Arrangements of tuyères   | 3/10        | • Details, accessories, or equipment, e.g. dust-collectors, peculiar to hearth-type furnaces  |
| 1/18 • • Arrangements of dust collectors   | 3/12        | • • Working chambers or casings; Supports therefor  |
| 1/20 • • Arrangement of devices for charging [4]   |             |   |
| 1/21 • • Arrangement of devices for discharging [4]  |             |   |

- 3/14 • • • Arrangements of linings
- 3/16 • • • Walls; Roofs
- 3/18 • • Arrangement of devices for charging [4]
- 3/19 • • Arrangement of devices for discharging [4]
- 3/20 • • Arrangements of heating devices
- 3/22 • • Arrangements of air or gas supply devices
- 3/24 • • Cooling arrangements
- 3/26 • • Arrangements of heat-exchange apparatus
- 3/28 • • Arrangement of controlling, monitoring, alarm or like devices [4]
- 5/00 Muffle furnaces; Retort furnaces; Other furnaces in which the charge is held completely isolated** (F27B 9/00 takes precedence)
- 5/02 • of multiple-chamber type
- 5/04 • adapted for treating the charge in vacuum or special atmosphere
- 5/05 • • in vacuum [5]
- 5/06 • Details, accessories, or equipment peculiar to furnaces of these types
- 5/08 • • Arrangements of linings
- 5/10 • • Muffles
- 5/12 • • Arrangement of devices for charging [4]
- 5/13 • • Arrangement of devices for discharging [4]
- 5/14 • • Arrangements of heating devices
- 5/16 • • Arrangements of air or gas supply devices
- 5/18 • • Arrangement of controlling, monitoring, alarm or like devices [4]
- 7/00 Rotary-drum furnaces, i.e. horizontal or slightly inclined**
- 7/02 • of multiple-chamber or multiple-drum type
- 7/04 • • with longitudinal divisions
- 7/06 • adapted for treating the charge in vacuum or special atmosphere
- 7/08 • externally heated
- 7/10 • internally heated, e.g. by means of passages in the wall
- 7/12 • tiltable
- 7/14 • with means for agitating or moving the charge
- 7/16 • • the means being fixed relatively to the drum (F27B 7/04 takes precedence)
- 7/18 • • the means being movable within the drum
- 7/20 • Details, accessories, or equipment peculiar to rotary-drum furnaces
- 7/22 • • Rotary drums; Supports therefor
- 7/24 • • • Seals between rotary and stationary parts
- 7/26 • • Drives
- 7/28 • • Arrangements of linings
- 7/30 • • Arrangements of partitions
- 7/32 • • Arrangement of devices for charging [4]
- 7/33 • • Arrangement of devices for discharging [4]
- 7/34 • • Arrangements of heating devices
- 7/36 • • Arrangements of air or gas supply devices
- 7/38 • • Arrangements of cooling devices
- 7/40 • • • Planetary coolers [4]
- 7/42 • • Arrangement of controlling, monitoring, alarm or like devices [4]
- 9/00 Furnaces through which the charge is moved mechanically, e.g. of tunnel type** (F27B 7/14 takes precedence); **Similar furnaces in which the charge moves by gravity**
- 9/02 • of multiple-track type; of multiple-chamber type; Combinations of furnaces
- 9/04 • adapted for treating the charge in vacuum or special atmosphere
- 9/06 • heated without contact between combustion gases and charge; electrically heated
- 9/08 • • heated through chamber walls
- 9/10 • • heated by hot air or gas
- 9/12 • with special arrangements for preheating or cooling the charge
- 9/14 • characterised by the path of the charge during treatment; characterised by the means by which the charge is moved during treatment (F27B 9/28 takes precedence; travelling or movable supports or containers for the charge F27D 3/12)
- 9/16 • • the charge moving in a circular or arcuate path
- 9/18 • • • under the action of scrapers or pushers
- 9/20 • • the charge moving in a substantially straight path
- 9/22 • • • under the action of scrapers or pushers (F27B 9/26 takes precedence)
- 9/24 • • • being carried by a conveyer
- 9/26 • • • on or in trucks, sleds, or containers
- 9/28 • for treating continuous lengths of work
- 9/30 • Details, accessories, or equipment peculiar to furnaces of these types
- 9/32 • • Casings
- 9/34 • • • Arrangements of linings
- 9/36 • • Arrangements of heating devices
- 9/38 • • Arrangement of devices for charging [4]
- 9/39 • • Arrangement of devices for discharging [4]
- 9/40 • • Arrangements of controlling or monitoring devices
- 11/00 Bell-type furnaces** (for treating metal strips or wire C21D 9/663)
- 13/00 Furnaces with both stationary charge and progression of heating, e.g. of ring type, of type in which segmental kiln moves over stationary charge**
- 13/02 • of multiple-chamber type with permanent partitions; Combinations of furnaces
- 13/04 • of single-chamber type with temporary partitions
- 13/06 • Details, accessories, or equipment peculiar to furnaces of this type
- 13/08 • • Casings
- 13/10 • • • Arrangements of linings
- 13/12 • • Arrangements of heating devices
- 13/14 • • Arrangement of controlling, monitoring, alarm or like devices [4]
- 14/00 Crucible or pot furnaces; Tank furnaces** [4]
- 14/02 • with tilting or rocking arrangements (F27B 14/04 takes precedence)
- 14/04 • adapted for treating the charge in vacuum or special atmosphere
- 14/06 • heated electrically, e.g. induction crucible furnaces, with or without any other source of heat (F27B 14/04 takes precedence)
- 14/08 • Details peculiar to crucible, pot or tank furnaces [4]
- 14/10 • • Crucibles
- 14/12 • • • Covers therefor
- 14/14 • • Arrangements of heating devices
- 14/16 • • Arrangement of devices for charging [4]
- 14/18 • • Arrangement of devices for discharging [4]
- 14/20 • • Arrangement of controlling, monitoring, alarm or like devices [4]

**F27B**

- 15/00 Fluidised-bed furnaces; Other furnaces using or treating finely-divided materials in dispersion** (combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles F23C 10/00)
- 15/02 • Details, accessories, or equipment peculiar to furnaces of these types
- 15/04 • • Casings; Supports therefor
- 15/06 • • • Arrangements of linings
- 15/08 • • Arrangement of devices for charging [4]
- 15/09 • • Arrangement of devices for discharging [4]
- 15/10 • • Arrangements of air or gas supply devices
- 15/12 • • Arrangements of dust collectors
- 15/14 • • Arrangements of heating devices
- 15/16 • • Arrangements of cooling devices
- 15/18 • • Arrangements of controlling devices
- 15/20 • • Arrangements of monitoring devices, of indicators, of alarm devices
- 17/00 Furnaces of a kind not covered by any of groups F27B 1/00-F27B 15/00** (structural combinations of furnaces F27B 19/02)

- 17/02 • specially designed for laboratory use
- 19/00 Combinations of different kinds of furnaces that are not all covered by any single one of main groups F27B 1/00-F27B 17/00**
- 19/02 • combined in one structure
- 19/04 • arranged for associated working
- 21/00 Open or uncovered sintering apparatus; Other heat-treatment apparatus of like construction**
- 21/02 • Sintering grates or tables
- 21/04 • Sintering pots or sintering pans
- 21/06 • Endless-strand sintering machines
- 21/08 • Details, accessories, or equipment peculiar to sintering or like apparatus [4]
- 21/10 • • Arrangement of devices for charging [4]
- 21/12 • • Arrangement of devices for discharging [4]
- 21/14 • • Arrangement of controlling, monitoring, alarm or like devices [4]

**F27D DETAILS OR ACCESSORIES OF FURNACES, KILNS, OVENS, OR RETORTS, IN SO FAR AS THEY ARE OF KINDS OCCURRING IN MORE THAN ONE KIND OF FURNACE** (combustion apparatus F23; electric heating H05B)

**Note(s)**

Attention is drawn to the references and Notes following the title of class F27 and Note (3) of section H.

**Subclass index**

CONSTRUCTIONAL FEATURES.....1/00  
 HANDLING AND SUPPORTING CHARGE.....3/00, 5/00, 15/00  
 PREHEATING CHARGE; COOLING; USING WASTE HEAT OR GASES.....13/00, 9/00, 15/02, 17/00  
 ARRANGEMENTS OF ELECTRIC HEATING ELEMENTS.....11/00  
 ARRANGEMENTS OF CONTROL AND SAFETY DEVICES.....19/00, 21/00  
 OTHER FEATURES; OTHER DETAILS.....7/00, 25/00, 27/00, 99/00

- 
- 1/00 Casings; Linings; Walls; Roofs** (refractory materials C04B; firebridges for combustion chambers F23M 3/00)
  - 1/02 • Crowns; Roofs
  - 1/04 • characterised by the form of the bricks or blocks used
  - 1/06 • • Composite bricks or blocks
  - 1/08 • • • Bricks or blocks with internal reinforcement or metal backing
  - 1/10 • Monolithic linings; Supports therefor
  - 1/12 • incorporating cooling arrangements (constructions of tube assemblies in general F28)
  - 1/14 • Supports for linings (F27D 1/10 takes precedence)
  - 1/16 • Making or repairing linings
  - 1/18 • Door frames; Doors, lids, removable covers
  - 3/00 Charging; Discharging; Manipulation of charge** (conveying systems characterised by their application for specified purposes not otherwise provided for B65G 49/00; moving charge through a furnace F27B 9/14)
  - 3/02 • Skids or tracks for heavy objects
  - 3/04 • Ram or pusher apparatus
  - 3/06 • Charging or discharging machines on travelling carriages
  - 3/08 • Screw feeders; Screw dischargers
  - 3/10 • Charging directly from hoppers or shoots
  - 3/12 • Travelling or movable supports or containers for the charge
  - 3/14 • Charging or discharging liquid or molten material
  - 3/15 • Tapping equipment; Equipment for removing slag
  - 3/16 • Introducing a fluid jet or current into the charge (F27D 3/18 takes precedence) [3]
  - 3/18 • Charging particulate material using a fluid carrier [3]
  - 5/00 Supports, screens, or the like for the charge within the furnace** (travelling or movable supports F27D 3/12)
  - 7/00 Forming, maintaining, or circulating atmospheres in heating chambers**
  - 7/02 • Supplying steam, vapour, gases, or liquids
  - 7/04 • Circulating atmospheres by mechanical means
  - 7/06 • Forming or maintaining special atmospheres or vacuum within heating chambers (F27D 7/02 takes precedence)
  - 9/00 Cooling of furnaces or of charges therein** (F27D 1/00, F27D 3/00 take precedence)
  - 11/00 Arrangement of elements for electric heating in or on furnaces** (electric heating *per se* H05B)
  - 11/02 • Ohmic resistance heating
  - 11/04 • • with direct passage of current through the material being heated

11/06	• Induction heating, i.e. in which the material being heated, or its container or elements embodied therein, form the secondary of a transformer	17/00	<b>Arrangement for using waste heat</b> (heat-exchangers <i>per se</i> F28); <b>Arrangement for using, or disposing of, waste gases</b> (removing fumes in general B08B 15/00)
11/08	• Heating by electric discharge, e.g. arc discharge	19/00	<b>Arrangement of controlling devices</b>
11/10	• • Disposition of electrodes (automatic control of temperature G05D 23/00; electric discharge apparatus H01T; arrangements for feeding or guiding electrodes H05B 7/10; automatic control of power by positioning of electrodes H05B 7/144) [3]	21/00	<b>Arrangement of monitoring devices; Arrangements of safety devices</b>
11/12	• with electromagnetic fields acting directly on the material being heated	21/02	• Observation or illuminating devices
13/00	<b>Apparatus for preheating charges; Arrangements for preheating charges</b>	21/04	• Arrangements of indicators or alarms
15/00	<b>Handling or treating discharged material; Supports or receiving chambers therefor</b>	25/00	<b>Devices for removing incrustations [2010.01]</b>
15/02	• Cooling	27/00	<b>Stirring devices for molten material</b> (F27D 3/14 takes precedence) [2010.01]
		99/00	<b>Subject matter not provided for in other groups of this subclass [2010.01]</b>

## F28 HEAT EXCHANGE IN GENERAL

### Note(s)

- In this class, the following expressions are used with the meanings indicated:
  - "heat exchange" means the heating or cooling of a fluid or fluent solid by direct or indirect contact with a heated or cooled fluid or fluent solid;
  - "heat transfer" means the heating or cooling of a fluid or fluent solid by direct contact with a heated or cooled surface or body.
- Apparatus using heat exchange or heat transfer (as defined in Note (1) above) for specific purposes is classified either in subclass F28B or in the appropriate subclasses of, for example, classes F22, F24, F25, F26, or F27; if no such other subclass is appropriate, such apparatus is classified in subclass F28C or F28D.

**F28B STEAM OR VAPOUR CONDENSERS** (condensation of vapours B01D 5/00; condensation during pretreatment of gases prior to electrostatic precipitation of dispersed particles B03C 3/014; steam engine plants having condensers F01K; liquefaction of gases F25J; details of heat-exchange or heat-transfer arrangements of general application F28F)

1/00	<b>Condensers in which the steam or vapour is separated from the cooling medium by walls, e.g. surface condenser</b>	5/00	<b>Condensers employing a combination of the methods covered by groups F28B 1/00 and F28B 3/00; Other condensers</b>
1/02	• using water or other liquid as the cooling medium	7/00	<b>Combinations of two or more condensers, e.g. provision of reserve condenser</b>
1/04	• • employing moving walls	9/00	<b>Auxiliary systems, arrangements, or devices</b>
1/06	• using air or other gas as the cooling medium	9/02	• for feeding steam or vapour to condensers
1/08	• • employing moving walls [3]	9/04	• for feeding, collecting, and storing cooling water or other cooling liquid
3/00	<b>Condensers in which the steam or vapour comes into direct contact with the cooling medium</b>	9/06	• • with provision for re-cooling the cooling water or other cooling liquid
3/02	• by providing a flowing coating of cooling liquid on the condensing surface	9/08	• for collecting and removing condensate
3/04	• by injecting cooling liquid into the steam or vapour (F28B 3/08 takes precedence)	9/10	• for extracting, cooling, and removing non-condensable gases
3/06	• by injecting the steam or vapour into the cooling liquid (F28B 3/08 takes precedence)	11/00	<b>Controlling arrangements with features specially adapted for condensers</b>
3/08	• with rotatable members		

**F28C HEAT-EXCHANGE APPARATUS, NOT PROVIDED FOR IN ANOTHER SUBCLASS, IN WHICH THE HEAT-EXCHANGE MEDIA COME INTO DIRECT CONTACT WITHOUT CHEMICAL INTERACTION** (heat-transfer, heat-exchange or heat-storage materials C09K 5/00; fluid heaters having heat generating means F24H; with an intermediate heat-transfer medium coming into direct contact with heat-exchange media F28D 15/00-F28D 19/00; details of heat-exchange apparatus of general application F28F)

1/00	<b>Direct-contact trickle coolers, e.g. cooling towers</b>	(building construction E04H 5/12; enclosed spaces)
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F28C

	cooled by trickle F25; component parts of trickle coolers F28F 25/00)	3/02	• the heat-exchange media both being gases or vapours
		3/04	• the heat-exchange media both being liquids
1/02	• with counter-current only	3/06	• the heat-exchange media being a liquid and a gas or vapour (temperators for cooling steam F22)
1/04	• with cross-current only		
1/06	• with both counter-current and cross-current	3/08	• • with change of state, e.g. absorption, evaporation, condensation (generating steam under pressure F22)
1/08	• Arrangements for recovering heat from exhaust steam		
1/10	• Arrangements for suppressing noise [5]	3/10	• one heat-exchange medium at least being a fluent solid, e.g. a particulate material
1/12	• Arrangements for preventing clogging by frost [3]		
1/14	• comprising also a non-direct contact heat exchange [3]	3/12	• • the heat-exchange medium being a particulate material and a gas, vapour, or liquid
1/16	• Arrangements for preventing condensation, precipitation or mist formation, outside the cooler (F28C 1/14 takes precedence) [3]	3/14	• • • the particulate material moving by gravity, e.g. down a tube
		3/16	• • • the particulate material forming a bed, e.g. fluidised, on vibratory sieves
3/00	<b>Other direct-contact heat-exchange apparatus</b>	3/18	• • • the particulate material being contained in rotating drums

**F28D HEAT-EXCHANGE APPARATUS, NOT PROVIDED FOR IN ANOTHER SUBCLASS, IN WHICH THE HEAT-EXCHANGE MEDIA DO NOT COME INTO DIRECT CONTACT** (heat-transfer, heat-exchange or heat-storage materials C09K 5/00; fluid heaters having heat generating means and heat transferring means F24H; furnaces F27; details of heat-exchange apparatus of general application F28F); **HEAT STORAGE PLANTS OR APPARATUS IN GENERAL [4]**

Subclass index

HEAT-EXCHANGE APPARATUS WITHOUT INTERMEDIATE HEAT-TRANSFER MEDIA OR BODIES

With stationary conduit assemblies

for only one medium using: mass of fluid; trickle or film; the cooling effect of evaporation.....1/00, 3/00, 5/00

for both media: by tubular conduits; by plate-like conduits.....7/00, 9/00

With moving conduit assemblies.....11/00

With fluidised bed.....13/00

HEAT-EXCHANGE APPARATUS WITH INTERMEDIATE HEAT-TRANSFER MEDIA OR BODIES

With the intermediate medium in closed tubes passing into or through the conduit walls.....15/00

In which the intermediate medium or body is contacted successively by the other media.....17/00, 19/00

HEAT STORAGE PLANTS OR APPARATUS.....20/00

OTHER HEAT-EXCHANGE APPARATUS.....21/00

1/00	<b>Heat-exchange apparatus having stationary conduit assemblies for one heat-exchange medium only, the media being in contact with different sides of the conduit wall, in which the other heat-exchange medium is a large body of fluid, e.g. domestic or motor car radiators</b> (F28D 5/00 takes precedence)	5/00	<b>Heat-exchange apparatus having stationary conduit assemblies for one heat-exchange medium only, the media being in contact with different sides of the conduit wall, using the cooling effect of natural or forced evaporation</b>
1/02	• with the heat-exchange conduits immersed in the body of fluid	5/02	• in which the evaporating medium flows in a continuous film or trickles freely over the conduits
1/03	• • with plate-like or laminated conduits [4]		
1/04	• • with tubular conduits	7/00	<b>Heat-exchange apparatus having stationary tubular conduit assemblies for both heat-exchange media, the media being in contact with different sides of a conduit wall</b>
1/047	• • • the conduits being bent, e.g. in a serpentine or zig-zag [4]	7/02	• the conduits being helically coiled (F28D 7/10 takes precedence)
1/053	• • • the conduits being straight [4]	7/04	• the conduits being spirally coiled (F28D 7/10 takes precedence)
1/06	• with the heat-exchange conduits forming part of, or being attached to, the tank containing the body of fluid	7/06	• the conduits having a single U-bend (F28D 7/10 takes precedence)
3/00	<b>Heat-exchange apparatus having stationary conduit assemblies for one heat-exchange medium only, the media being in contact with different sides of the conduit wall, in which the other heat-exchange medium flows in a continuous film, or trickles freely, over the conduits</b> (F28D 5/00 takes precedence)	7/08	• the conduits being otherwise bent, e.g. in a serpentine or zig-zag (F28D 7/10 takes precedence)
3/02	• with tubular conduits	7/10	• the conduits being arranged one within the other, e.g. concentrically
3/04	• Distributing arrangements	7/12	• the surrounding tube being closed at one end, i.e. return type (F28D 7/14 takes precedence)
		7/14	• • both tubes being bent

- 7/16 • the conduits being arranged in parallel spaced relation (F28D 7/02-F28D 7/10 take precedence) [4]
- 9/00 Heat-exchange apparatus having stationary plate-like or laminated conduit assemblies for both heat-exchange media, the media being in contact with different sides of a conduit wall**
- 9/02 • the heat-exchange media travelling at an angle to one another (F28D 9/04 takes precedence)
- 9/04 • the conduits being formed by spirally-wound plates or laminae
- 11/00 Heat-exchange apparatus employing moving conduits**
- 11/02 • the movement being rotary, e.g. performed by a drum or roller (F28D 11/08 takes precedence)
- 11/04 • • performed by a tube or a bundle of tubes
- 11/06 • the movement being reciprocating or oscillating (F28D 11/08 takes precedence)
- 11/08 • more than one conduit assembly performing independent movements, e.g. rotary bundle of tubes in a rotary drum
- 13/00 Heat-exchange apparatus using a fluidised bed**
- 15/00 Heat-exchange apparatus with the intermediate heat-transfer medium in closed tubes passing into or through the conduit walls**
- 15/02 • in which the medium condenses and evaporates, e.g. heat-pipes [4]
- 15/04 • • with tubes having a capillary structure [6]
- 15/06 • • Control arrangements therefor [6]
- 17/00 Regenerative heat-exchange apparatus in which a stationary intermediate heat-transfer medium or body is contacted successively by each heat-exchange medium, e.g. using granular particles**
- 17/02 • using rigid bodies, e.g. of porous material
- 17/04 • Distributing arrangements for the heat-exchange media
- 19/00 Regenerative heat-exchange apparatus in which the intermediate heat-transfer medium or body is moved successively into contact with each heat-exchange medium**
- 19/02 • using granular particles
- 19/04 • using rigid bodies, e.g. mounted on a movable carrier
- 20/00 Heat storage plants or apparatus in general** (specially adapted for particular applications, see the relevant places, e.g. F24D 15/02); **Regenerative heat-exchange apparatus not covered by groups F28D 17/00 or F28D 19/00** [4]
- 20/02 • using latent heat [6]
- 
- 21/00 Heat-exchange apparatus not covered by any of the groups F28D 1/00-F28D 20/00** [4]

**Heat-exchange apparatus employing intermediate heat-transfer media or bodies [3]**

**F28F DETAILS OF HEAT-EXCHANGE OR HEAT-TRANSFER APPARATUS, OF GENERAL APPLICATION** (heat-transfer, heat-exchange or heat-storage materials C09K 5/00; water or air traps, air venting F16)

**Subclass index**

**DETAILS AND THEIR ARRANGEMENTS**

Elements for heat exchange or transfer and assemblies thereof

tubular; plate-like; for movement; others.....1/00, 3/00, 5/00, 7/00

auxiliary supports for elements; sealing.....9/00, 11/00

Casings and header boxes.....9/00

Preventing deposits or corrosion.....17/00, 19/00

Special features of heat-exchange apparatus

characterised by the selection of: constructional material; intermediate heat-exchange material.....21/00, 23/00

component parts of trickle coolers.....25/00

MODIFYING HEAT-TRANSFER; CONTROL OF APPARATUS.....13/00, 27/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

- 
- 1/00 Tubular elements; Assemblies of tubular elements** (specially adapted for movement F28F 5/00)
- 1/02 • Tubular elements of cross-section which is non-circular (F28F 1/08, F28F 1/10 take precedence)
- 1/04 • • polygonal, e.g. rectangular
- 1/06 • • crimped or corrugated in cross-section
- 1/08 • Tubular elements crimped or corrugated in longitudinal section
- 1/10 • Tubular elements or assemblies thereof with means for increasing heat-transfer area, e.g. with fins, with projections, with recesses (crimped or corrugated elements F28F 1/06, F28F 1/08)
- 1/12 • • the means being only outside the tubular element
- 1/14 • • • and extending longitudinally (F28F 1/38 takes precedence)
- 1/16 • • • the means being integral with the element, e.g. formed by extrusion (F28F 1/22 takes precedence)
- 1/18 • • • • the element being built-up from finned sections
- 1/20 • • • • the means being attachable to the element (F28F 1/22 takes precedence)
- 1/22 • • • • the means having portions engaging further tubular elements
- 1/24 • • • and extending transversely (F28F 1/38 takes precedence)
- 1/26 • • • • the means being integral with the element (F28F 1/32 takes precedence)
- 1/28 • • • • the element being built-up from finned sections

- 1/30 • • • • the means being attachable to the element (F28F 1/32 takes precedence)
- 1/32 • • • • the means having portions engaging further tubular elements
- 1/34 • • • and extending obliquely (F28F 1/38 takes precedence)
- 1/36 • • • • the means being helically-wound fins or wire spirals
- 1/38 • • • and being staggered to form tortuous fluid passages
- 1/40 • • the means being only inside the tubular element
- 1/42 • • the means being both outside and inside the tubular element
- 1/44 • • • and being formed of wire mesh
- 3/00 Plate-like or laminated elements; Assemblies of plate-like or laminated elements** (specially adapted for movement F28F 5/00)
- 3/02 • Elements or assemblies thereof with means for increasing heat-transfer area, e.g. with fins, with recesses, with corrugations (F28F 3/08 takes precedence)
- 3/04 • • the means being integral with the element
- 3/06 • • the means being attachable to the element
- 3/08 • Elements constructed for building-up into stacks, e.g. capable of being taken apart for cleaning
- 3/10 • • Arrangement for sealing the margins
- 3/12 • Elements constructed in the shape of a hollow panel, e.g. with channels
- 3/14 • • by separating portions of a pair of joined sheets to form channels, e.g. by inflation (manufacture thereof B23P)
- 5/00 Elements specially adapted for movement** (arrangements for moving the elements, see the appropriate subclass for the apparatus concerned)
- 5/02 • Rotary drums or rollers
- 5/04 • Hollow impellers, e.g. stirring vane
- 5/06 • Hollow screw conveyers
- 7/00 Elements not covered by group F28F 1/00, F28F 3/00, or F28F 5/00**
- 7/02 • Blocks traversed by passages for heat-exchange media
- 9/00 Casings; Header boxes; Auxiliary supports for elements; Auxiliary members within casings**
- 9/007 • Auxiliary supports for elements [6]
- 9/013 • • for tubes or tube-assemblies [6]
- 9/02 • Header boxes; End plates
- 9/04 • • Arrangements for sealing elements into header boxes or end plates (joining pipes to walls in general F16L 41/00)
- 9/06 • • • by dismountable joints
- 9/08 • • • • by wedge-type connections, e.g. taper ferrule
- 9/10 • • • • by screw-type connections, e.g. gland
- 9/12 • • • • by flange-type connections
- 9/14 • • • • by force-joining
- 9/16 • • • by permanent joints, e.g. by rolling (metal-working procedures in general B21, B23, particularly B21D 39/06, B23K)
- 9/18 • • • • by welding
- 9/20 • Arrangements of heat reflectors, e.g. separately-insertible reflecting walls
- 9/22 • Arrangements for directing heat-exchange media into successive compartments, e.g. arrangements of guide plates
- 9/24 • Arrangements for promoting turbulent flow of heat-exchange media, e.g. by plates (F28F 1/38 takes precedence; in general F15D)
- 9/26 • Arrangements for connecting different sections of heat-exchange elements, e.g. of radiators (connecting different sections in water heaters F24H 9/14)
- 11/00 Arrangements for sealing leaky tubes or conduits** (stopping flow from or in pipes in general F16L 55/10)
- 11/02 • using obturating elements, e.g. washers, inserted and operated independently of each other (F28F 11/06 takes precedence)
- 11/04 • using pairs of obturating elements, e.g. washers, mounted upon central operating rods (F28F 11/06 takes precedence)
- 11/06 • using automatic tube-obturating appliances
- 13/00 Arrangements for modifying heat transfer, e.g. increasing, decreasing** (F28F 1/00-F28F 11/00 take precedence)
- 13/02 • by influencing fluid boundary (boundary-layer control in general F15D)
- 13/04 • by preventing the formation of continuous films of condensate on heat-exchange surfaces, e.g. by promoting droplet formation
- 13/06 • by affecting the pattern of flow of the heat-exchange media
- 13/08 • • by varying the cross-section of the flow channels
- 13/10 • • by imparting a pulsating motion to the flow, e.g. by sonic vibration
- 13/12 • • by creating turbulence, e.g. by stirring, by increasing the force of circulation (F28F 13/08 takes precedence)
- 13/14 • by endowing the walls of conduits with zones of different degrees of conduction of heat
- 13/16 • by applying an electrostatic field to the body of the heat-exchange medium
- 13/18 • by applying coatings, e.g. radiation-absorbing, radiation-reflecting; by surface treatment, e.g. polishing
- 17/00 Removing ice or water from heat-exchange apparatus**
- 19/00 Preventing the formation of deposits or corrosion, e.g. by using filters**
- 19/01 • by using means for separating solid materials from heat-exchange fluids, e.g. filters [6]
- 19/02 • by using coatings, e.g. vitreous or enamel coatings
- 19/04 • • of rubber; of plastics material; of varnish
- 19/06 • • of metal
- 21/00 Constructions of heat-exchange apparatus characterised by the selection of particular materials**
- 21/02 • of carbon, e.g. graphite
- 21/04 • of ceramic; of concrete; of natural stone
- 21/06 • of plastics material
- 21/08 • of metal
- 23/00 Features relating to the use of intermediate heat-exchange materials, e.g. selection of compositions**
- 23/02 • Arrangements for obtaining or maintaining same in a liquid state
- 25/00 Component parts of trickle coolers** (arrangements for increasing heat transfer F28F 13/00; controlling arrangements F28F 27/00)
- 25/02 • for distributing, circulating, or accumulating liquid (spraying or atomising in general B05B, B05D)

25/04	• • Distributing or accumulator troughs	27/00	<b>Control arrangements or safety devices specially adapted for heat-exchange or heat-transfer apparatus</b>
25/06	• • Spray nozzles or spray pipes	27/02	• for controlling the distribution of heat-exchange media between different channels (arrangements of guide plates or guide vanes F28F 9/22, F28F 25/12)
25/08	• • Splashing boards or grids, e.g. for converting liquid sprays into liquid films; Elements or beds for increasing the area of the contact surface (packing elements in general B01J 19/30, B01J 19/32)	99/00	<b>Subject matter not provided for in other groups of this subclass [2006.01]</b>
25/10	• for feeding gas or vapour		
25/12	• • Ducts; Guide vanes, e.g. for carrying currents to distinct zones		

**F28G CLEANING OF INTERNAL OR EXTERNAL SURFACES OF HEAT-EXCHANGE OR HEAT-TRANSFER CONDUITS, e.g. WATER TUBES OF BOILERS** (cleaning pipes or tubes in general B08B 9/02; devices or arrangements for removing water, minerals, or sludge from boilers while the boiler is in operation, or which remain in position while the boiler is in operation, or are specifically adapted to boilers without any other utility F22B 37/48; removal or treatment of combustion products or combustion residues F23J; removing ice from heat-exchange apparatus F28F 17/00)

### Subclass index

APPLIANCES FOR CLEANING: NON-ROTARY; ROTARY; OTHERS; DETAILS.....	1/00, 3/00, 13/00, 15/00
CLEANING PROCESSES BY: DISTORTION; VIBRATION; FLUSHING OR WASHING;	
COMBUSTION; OTHERS.....	5/00, 7/00, 9/00, 11/00, 13/00
COMBINATION OF PROCESSES.....	13/00

<b>1/00 Non-rotary, e.g. reciprocated, appliances</b> (F28G 3/00 takes precedence)	3/16	• using jets of fluid for removing debris
1/02 • having brushes (brushes A46B)	<b>5/00</b>	<b>Cleaning by distortion</b> (by vibration F28G 7/00)
1/04 • having articulated tools, e.g. assembled in chain manner	<b>7/00</b>	<b>Cleaning by vibration</b>
1/06 • having coiled wire tools, i.e. basket type	<b>9/00</b>	<b>Cleaning by flushing or washing, e.g. with chemical solvents</b> (appliances using jets of fluid for removing debris F28G 1/16, F28G 3/16)
1/08 • having scrapers, hammers, or cutters, e.g. rigidly mounted	<b>11/00</b>	<b>Cleaning by combustion processes, e.g. using squibs, using travelling burners</b>
1/10 • • resiliently mounted	<b>13/00</b>	<b>Appliances or processes not covered by groups F28G 1/00-F28G 11/00; Combinations of appliances or processes covered by groups F28G 1/00-F28G 11/00</b>
1/12 • Fluid-propelled scrapers, bullets, or like solid bodies	<b>15/00</b>	<b>Details</b> (measuring thickness of deposit G01B)
1/14 • Pull-through rods	15/02	• Supports for cleaning appliances, e.g. frames
1/16 • using jets of fluid for removing debris (F28G 1/12 takes precedence)	15/04	• Feeding or driving arrangements, e.g. power operation
<b>3/00 Rotary appliances</b>	15/06	• • Automatic reversing devices
3/02 • having abrasive tools	15/08	• Locating position of cleaning appliances within conduits
3/04 • having brushes (brushes A46B)	15/10	• Masks for delimiting area to be cleaned
3/06 • having articulated tools, e.g. assembled in chain manner		
3/08 • having coiled wire tools, i.e. basket type		
3/10 • having scrapers, hammers, or cutters, e.g. rigidly mounted		
3/12 • • resiliently mounted		
3/14 • • thrown into working position by centrifugal force		

**WEAPONS; BLASTING****F41 WEAPONS****Note(s)**

1. This class covers also means for practice and training which may have aspects of simulation, e.g. in apparatus for so-called "military games", although simulators are generally covered by class G09.
2. In this class, the following terms or expressions are used with the meanings indicated:
  - "smallarm" means a firearm which is generally held with one or both hands for firing, but this term also includes a light machine-gun which may be supported on a tripod or the like during firing;
  - "gun" means any weapon having a barrel and a trigger or firing mechanism for projecting a missile; it may be a piece of ordnance or a smallarm. It may use combustible or explosive propellant charges, air pressure, electromagnetism or other propulsive forces;
  - "revolver-type gun" means a gun having a revolving drum magazine, the chambers of which are used successively as firing chamber;
  - "revolver" means a revolver-type pistol;
  - "semi-automatic firearm" means a firearm from which one shot is fired after actuation of the trigger and which then returns to a condition for firing a subsequent shot upon renewed actuation of the trigger;
  - "automatic firearm" means a firearm which will continue firing so long as the initial firing pressure is maintained on the trigger;
  - "sighting" means bringing into visual coincidence a direction defined by a so-called "sighting" device with the direction of a target;
  - "aiming" means bringing a weapon to a direction differing from the sighting direction by corrections in order that the projectile may hit the target;
  - "laying" means setting a weapon in the correct position for hitting a target.
3. Attention is drawn to the definitions of "projectile", "missile" and "rocket" given in Note (2) following the title of class F42.

**F41A FUNCTIONAL FEATURES OR DETAILS COMMON TO BOTH SMALLARMS AND ORDNANCE, e.g. CANNONS; MOUNTINGS FOR SMALLARMS OR ORDNANCE [5]****Note(s)**

1. This subclass covers those features or details which are considered to be of a kind generally applicable to, or to be concerned with intrinsic functions common to, both smallarms and ordnance.
2. Such features or details are classified in this subclass, even if they are stated to be applied only to smallarms or only to ordnance.
3. Attention is drawn to the definitions given in Note (2) following the title of class F41.

**Subclass index**

KINDS OF PROPULSION.....	1/00
BREECH MECHANISMS.....	3/00
UNLOCKING MECHANISMS.....	5/00
GUN RECHARGERS, EXTERNALLY POWERED GUNS.....	7/00
FEEDING OR LOADING, MAGAZINES.....	9/00
ASSEMBLY FEATURES, MODULAR CONCEPTS, ARTICULATED OR COLLAPSIBLE GUNS.....	11/00
COOLING, HEATING, VENTILATING, BLOWING TROUGH.....	13/00
EXTRACTORS, EJECTORS.....	15/00
SAFETY ARRANGEMENTS.....	17/00
FIRING OR TRIGGER MECHANISMS, COCKING.....	19/00
BARRELS, GUN TUBES, MUZZLE ATTACHMENTS.....	21/00
GUN MOUNTINGS, e.g. on vehicles.....	23/00
Permitting recoil.....	25/00
Permitting elevation or traversing.....	27/00
CLEANING OR LUBRICATING.....	29/00
TESTING.....	31/00
ADAPTATIONS FOR TRAINING.....	33/00
OTHER ACCESSORIES OR DETAILS.....	35/00
SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....	99/00

**1/00 Missile propulsion characterised by the use of explosive or combustible propellant charges**  
(projecting missiles without use of explosive or combustible propellant charge F41B; launching rockets

or torpedoes F41F 3/00; missile self-propulsion F42B 15/00) [5]

- 1/02 • Hypervelocity missile propulsion using successive means for increasing the propulsive force, e.g. using successively initiated propellant charges arranged along the barrel length; Multistage missile propulsion [5]
- 1/04 • Missile propulsion using the combustion of a liquid or gaseous fuel, e.g. hypergolic fuel [5]
- 1/06 • Adjusting the range without varying elevation angle or propellant charge data, e.g. by venting a part of the propulsive charge gases, or by adjusting the capacity of the cartridge or combustion chamber [5]
- 1/08 • Recoilless guns, i.e. guns having propulsion means producing no recoil [5]
- 1/10 • • a counter projectile being used to balance recoil [5]
- 3/00 Breech mechanism, e.g. locks [5]**
- 3/02 • Block action, i.e. the main breech opening movement being transverse to the barrel axis [5]
- 3/04 • • with pivoting breech-block [5]
- 3/06 • • • about a horizontal axis transverse to the barrel axis at the rear of the block (F41A 3/08 takes precedence) [5]
- 3/08 • • • carrying a rotably mounted obturating plug of the screw-thread or the interrupted-thread type (F41A 3/30 takes precedence) [5]
- 3/10 • • with sliding breech-block, e.g. vertically [5]
- 3/12 • Bolt action, i.e. the main breech opening movement being parallel to the barrel axis [5]
- 3/14 • • Rigid bolt locks, i.e. having locking elements rigidly mounted on the bolt or bolt handle and on the barrel or breech-housing respectively [5]
- 3/16 • • • the locking elements effecting a rotary movement about the barrel axis, e.g. rotating cylinder bolt locks [5]
- 3/18 • • • • hand-operated [5]
- 3/20 • • • • • Straight-pull operated bolt locks, i.e. the operating hand effecting only a straight movement parallel to the barrel axis [5]
- 3/22 • • • • • the locking being effected by rotating the operating handle or lever transversely to the barrel axis [5]
- 3/24 • • • • • the locking elements forming part of the operating handle or lever [5]
- 3/26 • • • • • semi-automatically or automatically operated, e.g. having a slidable bolt-carrier and a rotatable bolt [5]
- 3/28 • • • • • having fixed locking elements on the non-rotating bolt and rotating locking elements mounted on the barrel or breech housing, e.g. rotatable rings [5]
- 3/30 • • • • • Interlocking means, e.g. locking lugs, screw threads [5]
- 3/32 • • • the bolt being rocked about a notional axis transverse to the barrel axis [5]
- 3/34 • • • the bolt additionally effecting a sliding movement transverse to the barrel axis [5]
- 3/36 • • Semi-rigid bolt locks, i.e. having locking elements movably mounted on the bolt or on the barrel or breech housing [5]
- 3/38 • • • having rocking locking elements, e.g. pivoting levers or vanes [5]
- 3/40 • • • • mounted on the bolt (F41A 3/42 takes precedence) [5]
- 3/42 • • • • hand-operated [5]
- 3/44 • • • having sliding locking elements, e.g. balls, rollers [5]
- 3/46 • • • • mounted on the bolt (F41A 3/48 takes precedence) [5]
- 3/48 • • • • hand-operated [5]
- 3/50 • • • Toggle-joint locks, e.g. crank-operated [5]
- 3/52 • • • • hand-operated [5]
- 3/54 • • Bolt locks of the unlocked type, i.e. being inertia operated [5]
- 3/56 • • • the bolt being provided with an additional slidable mass [5]
- 3/58 • Breakdown breech mechanisms, e.g. for shotguns [5]
- 3/60 • Breech mechanisms for guns having two or more barrels (F41A 3/58 takes precedence; for revolving-cannon guns F41F 1/10) [5]
- 3/62 • using combustion gas pressure for adding to the mechanical locking action, or for delaying breech opening movement [5]
- 3/64 • Mounting of breech-blocks; Accessories for breech-blocks or breech-block mountings [5]
- 3/66 • • Breech housings or frames; Receivers [5]
- 3/68 • • Bolt stops, i.e. means for limiting bolt opening movement [5]
- 3/70 • • Anti-rebound arrangements, i.e. preventing rebound of the bolt out of the firing position [5]
- 3/72 • • Operating handles or levers; Mounting thereof in breech-blocks or bolts [5]
- 3/74 • • Obturating or packing devices for gas leak prevention in breech mechanisms [5]
- 3/76 • • • specially adapted for sealing the gap between the forward end of the cartridge chamber and the rearward end of the barrel, e.g. sealing devices for revolvers or revolver-type guns [5]
- 3/78 • • Bolt buffer or recuperator means [5]
- 3/80 • • • Adjustable spring buffers [5]
- 3/82 • • • Coil spring buffers (F41A 3/80 takes precedence) [5]
- 3/84 • • • • mounted within the gun stock [5]
- 3/86 • • • • mounted under the barrel [5]
- 3/88 • • • • mounted around the barrel [5]
- 3/90 • • • Fluid buffers [5]
- 3/92 • • • • adjustable [5]
- 3/94 • • • • in combination with spring buffers [5]
- 5/00 Mechanisms or systems operated by propellant charge energy for automatically opening the lock [5]**
- 5/02 • recoil-operated [5]
- 5/04 • • the barrel being tilted during recoil [5]
- 5/06 • • the barrel being rotated about its longitudinal axis during recoil [5]
- 5/08 • • having an accelerator lever acting on the breech-block or bolt during the opening movement [5]
- 5/10 • • having a movable inertia weight [5]
- 5/12 • • • mounted in a gun having a fixed barrel [5]
- 5/14 • • Barrel stops, i.e. devices for holding the recoiling barrel in a predetermined position, e.g. the recoil position [5]
- 5/16 • • having a barrel moving forwardly after the firing of a shot [5]
- 5/18 • gas-operated [5]
- 5/20 • • using a gas piston arranged concentrically around the barrel [5]
- 5/22 • • having two or more gas pistons [5]
- 5/24 • • by direct action of gas pressure on bolt or locking elements [5]
- 5/26 • • Arrangements or systems for bleeding the gas from the barrel (F41A 5/20-F41A 5/24 take precedence) [5]

F41A

- 5/28 • • • Adjustable systems [5]
- 5/30 • Gas- or recoil-operation, e.g. selection of gas- or recoil-operated systems [5]
- 5/32 • Energy accumulator systems, i.e. systems for opening the breech-block by energy accumulated during barrel or gas piston recoil [5]
- 5/34 • • with spring accumulators [5]
- 5/36 • • with fluid accumulators [5]
- 7/00 **Auxiliary mechanisms for bringing the breech-block or bolt or the barrel to the starting position before automatic firing** (operating handles or levers F41A 3/00); **Drives for externally-powered guns** (revolving-cannon guns F41F 1/00); **Remote-controlled gun chargers** [5]
  - 7/02 • Machine-gun rechargers, e.g. manually operated [5]
  - 7/04 • • fluid operated [5]
  - 7/06 • • electrically operated [5]
  - 7/08 • Drives for externally-powered guns, i.e. drives for moving the breech-block or bolt by an external force during automatic firing [5]
  - 7/10 • • using a rotating cylindrical drum having a camming groove [5]
- 9/00 **Feeding or loading of ammunition** (adaptations for feeding or loading missiles from magazines in air guns F41B 11/02); **Magazines; Guiding means for the extracting of cartridges** (cartridge extractors or ejectors F41A 15/00) [5]
  - 9/01 • Feeding of unbelted ammunition [5]
  - 9/02 • • using wheel conveyers, e.g. star-wheel-shaped conveyers [5]
  - 9/03 • • using screw or rotary-spiral conveyers [5]
  - 9/04 • • using endless-chain belts carrying a plurality of ammunition [5]
  - 9/05 • • • in tandem sequence [5]
  - 9/06 • • using cyclically moving conveyers, i.e. conveyers having ammunition pusher or carrier elements which are emptied or disengaged from the ammunition during the return stroke [5]
  - 9/07 • • • Reciprocating conveyers, i.e. conveyers pushing a plurality of ammunition during the feeding stroke [5]
  - 9/09 • • • Movable ammunition carriers or loading trays, e.g. for feeding from magazines [5]
  - 9/10 • • • • pivoting or swinging [5]
  - 9/11 • • • • • in a horizontal plane [5]
  - 9/12 • • • • • mounted within a smallarm [5]
  - 9/13 • • • • • in a vertical plane [5]
  - 9/14 • • • • • transverse to the barrel axis [5]
  - 9/15 • • • • • • mounted within a smallarm [5]
  - 9/16 • • • • • • parallel to the barrel axis [5]
  - 9/17 • • • • • • • mounted within a smallarm [5]
  - 9/18 • • • • • • • • feeding from a magazine under the barrel [5]
  - 9/19 • • • • • • • • • feeding from a magazine mounted in the stock [5]
  - 9/20 • • • • • sliding, e.g. reciprocating [5]
  - 9/21 • • • • • in a vertical direction (F41A 9/23 takes precedence) [5]
  - 9/22 • • • • • in a horizontal direction (F41A 9/23 takes precedence) [5]
  - 9/23 • • • • • • mounted within a smallarm [5]
  - 9/24 • • using a movable magazine or clip as feeding element [5]
  - 9/25 • • • using a sliding clip [5]
  - 9/26 • • • using a revolving drum magazine [5]

- 9/27 • • • • in revolver-type guns [5]
- 9/28 • • • • • of smallarm type (in revolvers F41C 3/14) [5]
- 9/29 • Feeding of belted ammunition [5]
- 9/30 • • Sprocket-type belt transporters [5]
- 9/31 • • • with cartridge stripping means [5]
- 9/32 • • Reciprocating-slide-type belt transporters [5]
- 9/33 • • • with cartridge stripping means [5]
- 9/34 • • from magazines (magazines for belted ammunition *per se* F41A 9/79) [5]
- 9/35 • Feeding multibarrel guns [5]

**Note(s)**

Feeding elements or concepts of general interest, not specially adapted for feeding multibarrel guns, are classified in groups F41A 9/01 or F41A 9/29.

- 9/36 • • Feed mechanisms for revolving-cannon guns [5]
- 9/37 • Feeding two or more kinds of ammunition to the same gun; Feeding from two sides [5]

**Note(s)**

Feeding elements or concepts of general interest, not specially adapted for feeding two or more kinds of ammunition or from two sides, are classified in groups F41A 9/01 or F41A 9/29.

- 9/38 • Loading arrangements, i.e. for bringing the ammunition into the firing position [5]
- 9/39 • • Ramming arrangements [5]
- 9/40 • • • the breech-block itself being the rammer [5]
- 9/41 • • • • pushing unbelted ammunition from a box magazine on the gun frame into the cartridge chamber [5]
- 9/42 • • • Rammers separate from breech-block [5]
- 9/43 • • • • Chain rammers [5]
- 9/44 • • • • Fluid-operated piston rammers [5]
- 9/45 • • the cartridge chamber or the barrel as a whole being tiltable between a loading and a firing position [5]
- 9/46 • • the cartridge chamber being formed by two complementary elements, movable one relative to the other for loading [5]
- 9/47 • • using forwardly-sliding barrels or barrel parts for loading [5]
- 9/48 • • by gravitational force [5]
- 9/49 • Internally-powered drives, i.e. operated by propellant charge energy, e.g. couplings, clutches, energy accumulators [5]
- 9/50 • External power or control systems [5]
- 9/51 • • Boosters, i.e. externally-powered motors [5]
- 9/52 • Arrangements for changing from automatic or magazine-loading to hand-loading [5]
- 9/53 • Charged-condition indicators, i.e. indicating the presence of a cartridge in the cartridge chamber [5]
- 9/54 • Cartridge guides, stops or positioners, e.g. for cartridge extraction [5]
- 9/55 • • Fixed guiding means, mounted on, or near, the cartridge chamber [5]
- 9/56 • • Movable guiding means [5]
- 9/57 • • • Flexible chutes, e.g. for guiding belted ammunition from the magazine to the gun [5]
- 9/58 • • Cartridge stops; Cartridge positioners [5]
- 9/59 • Ejectors for clips or magazines, e.g. when empty [5]
- 9/60 • Empty-cartridge-case or belt-link collectors or catchers (F41A 9/81 takes precedence) [5]
- 9/61 • Magazines [5]

- 9/62 • • having means for indicating the number of cartridges left in the magazine, e.g. last-round indicators (last-round safeties F41A 17/40) [5]
- 9/63 • • specially adapted for releasable connection with other magazines [5]
- 9/64 • • for unbelted ammunition [5]
- 9/65 • • • Box magazines having a cartridge follower [5]
- 9/66 • • • • Arrangements thereon for charging, i.e. reloading (apparatus or tools for reloading magazines F41A 9/83) [5]
- 9/67 • • • • • having means for depressing the cartridge follower, or for locking it in a depressed position [5]
- 9/68 • • • • Plural magazines, e.g. tandem magazines [5]
- 9/69 • • • • characterised by multiple-row or zigzag arrangement of cartridges [5]
- 9/70 • • • • Arrangements thereon for discharging, e.g. cartridge followers or discharge throats [5]
- 9/71 • • • • Arrangements thereon for varying capacity; Adapters or inserts for changing cartridge size or type [5]
- 9/72 • • • Tubular magazines, i.e. magazines containing the ammunition in lengthwise tandem sequence [5]
- 9/73 • • • Drum magazines [5]
- 9/74 • • • • with radially disposed cartridges [5]
- 9/75 • • • • having a spiral cartridge channel [5]
- 9/76 • • • Magazines having an endless-chain conveyer [5]
- 9/77 • • • Magazines having a screw conveyer [5]
- 9/78 • • • Magazines having a reciprocating conveyer [5]
- 9/79 • • for belted ammunition [5]
- 9/80 • • • having provision for quick-coupling of the belts of adjacent magazines [5]
- 9/81 • • • having provision for collecting belt links or empty cartridge cases [5]
- 9/82 • Reloading of magazines [5]
- 9/83 • • Apparatus or tools for reloading magazines with unbelted ammunition, e.g. cartridge clips [5]
- 9/84 • • • Clips [5]
- 9/85 • • • for reloading revolver-type magazines [5]
- 9/86 • • Feeding belted ammunition into magazines [5]
- 9/87 • Ammunition handling dollies or transfer carts (F41A 9/86 takes precedence) [5]
- 11/00 Assembly or disassembly features; Modular concepts; Articulated or collapsible guns** (F41A 3/64, F41A 19/10-F41A 19/15, F41A 21/48, F41A 25/26 take precedence) [5]
- 11/02 • Modular concepts, e.g. weapon-family concepts [5]
- 11/04 • Articulated or collapsible guns, i.e. with hinged or telescopic parts for transport or storage (breakdown shotguns or rifles F41C 7/11; folding or telescopic stocks or stock parts F41C 23/04) [5]
- 11/06 • • Telescopic guns [5]
- 13/00 Cooling or heating systems** (barrels or gun tubes with fins or ribs F41A 21/00); **Blowing-through of gun barrels; Ventilating systems** [5]
- 13/02 • Heating systems [5]
- 13/04 • Injecting fluids into barrels or cartridge chambers (F41A 13/08 takes precedence) [5]
- 13/06 • Evacuating combustion gas from barrels (F41A 13/10 takes precedence) [5]
- 13/08 • • Bore evacuators, i.e. chambers disposed around barrels for storing part of the combustion gas and subsequently injecting it into the barrel to provide suction [5]
- 13/10 • Blowers or turbines for evacuating or cooling guns, e.g. driven by combustion gas pressure or recoil [5]
- 13/12 • Systems for cooling the outer surface of the barrel (F41A 13/10 takes precedence) [5]
- 15/00 Cartridge extractors, i.e. devices for pulling cartridges or cartridge cases at least partially out of the cartridge chamber; Cartridge ejectors, i.e. devices for throwing the extracted cartridges or cartridge cases free of the gun** (F41A 9/54 takes precedence) [5]
- 15/02 • for revolver-type guns, e.g. revolvers [5]
- 15/04 • specially adapted for cartridge cases being deformed when fired, e.g. of plastics [5]
- 15/06 • for breakdown guns [5]
- 15/08 • for block-action guns [5]
- 15/10 • • of sliding-block type [5]
- 15/12 • for bolt-action guns [5]
- 15/14 • • the ejector being mounted on, or within, the bolt [5]
- 15/16 • • the ejector being mounted on the breech housing or frame [5]
- 15/18 • for guns with forwardly slidable barrels [5]
- 15/20 • specially adapted for caseless-ammunition duds [5]
- 15/22 • Tools for extracting cartridges [5]
- 17/00 Safety arrangements, e.g. safeties** [5]
- 17/02 • Key-operated safeties [5]
- 17/04 • Safeties of the combination-lock type (F41A 17/02 takes precedence) [5]
- 17/06 • Electric or electromechanical safeties (F41A 17/04, F41A 17/08 take precedence) [5]
- 17/08 • for inhibiting firing in a specified direction, e.g. at a friendly person or at a protected area (F41A 27/02 takes precedence) [5]
- 17/10 • • Firing mechanisms with elevation stop [5]
- 17/12 • • Firing mechanisms with anti-canting safety [5]
- 17/14 • Double-loading prevention [5]
- 17/16 • Cook-off prevention, i.e. prevention of spontaneous firing of a cartridge by chamber wall heat [5]
- 17/18 • Hang-fire prevention [5]
- 17/20 • Grip or stock safeties, i.e. safeties disengaged by clasping the grip or stock (thumb-operated sliding safeties F41A 17/52, F41A 17/62, F41A 17/70, F41A 17/80) [5]
- 17/22 • • acting on the trigger [5]
- 17/24 • • acting on the firing pin [5]
- 17/26 • • acting on the hammer [5]
- 17/28 • • acting on the sear [5]
- 17/30 • Multiple safeties, i.e. safeties acting on at least one element of the firing mechanism and at least one other element of the gun, e.g. the moving barrel [5]
- 17/32 • • the other element being the breech-block or bolt [5]
- 17/34 • Magazine safeties [5]
- 17/36 • • locking the gun in a safety condition when the magazine is empty or removed [5]
- 17/38 • • locking the magazine in the gun [5]
- 17/40 • Last-round safeties (F41A 17/34 takes precedence) [5]
- 17/42 • Safeties for locking the breech-block or bolt in a safety position (F41A 17/32, F41A 17/36, F41A 17/40 take precedence) [5]

F41A

- 17/44 • Safety plugs, e.g. for plugging-up cartridge chambers [5]
- 17/46 • Trigger safeties, i.e. means for preventing trigger movement (F41A 17/02-F41A 17/40 take precedence) [5]
- 17/48 • • Automatically operated trigger safeties, i.e. operated by breech opening or closing movement [5]
- 17/50 • • • by breakdown action [5]
- 17/52 • • Thumb-operated sliding safeties mounted on the upside of the stock, e.g. for shotguns [5]
- 17/54 • • Protecting-caps for trigger guards; Trigger locking pieces mounted on, or within, the trigger guard [5]
- 17/56 • Sear safeties, i.e. means for rendering ineffective an intermediate lever transmitting trigger movement to firing pin, hammer, bolt or sear (F41A 17/02-F41A 17/40 take precedence) [5]
- 17/58 • • automatically operated, i.e. operated by breech opening or closing movement [5]
- 17/60 • • • by breakdown action [5]
- 17/62 • • Thumb-operated sliding safeties mounted on the upside of the stock, e.g. for shotguns [5]
- 17/64 • Firing-pin safeties, i.e. means for preventing movement of slidably-mounted strikers (F41A 17/02-F41A 17/40 take precedence) [5]
- 17/66 • • automatically operated, i.e. operated by breech opening or closing movement [5]
- 17/68 • • • by breakdown action [5]
- 17/70 • • Thumb-operated sliding safeties mounted on the upside of the stock, e.g. for shotguns [5]
- 17/72 • • trigger-operated, i.e. the movement of the trigger bringing a firing-pin safety into inoperative position during the firing [5]
- 17/74 • Hammer safeties, i.e. for preventing the hammer from hitting the cartridge or the firing pin (F41A 17/02-F41A 17/40 take precedence) [5]
- 17/76 • • automatically operated, i.e. operated by breech opening or closing movement [5]
- 17/78 • • • by breakdown action [5]
- 17/80 • • Thumb-operated sliding safeties mounted on the upside of the stock, e.g. for shotguns [5]
- 17/82 • • trigger-operated, i.e. the movement of the trigger bringing a hammer safety into inoperative position during firing [5]
- 19/00 Firing or trigger mechanisms; Cocking mechanisms [5]**
- 19/01 • Counting means indicating the number of shots fired [5]
- 19/02 • • Burst limiters (F41A 19/67 takes precedence) [5]
- 19/03 • Shot-velocity control (F41A 3/78, F41A 5/28, F41A 19/05, F41A 19/66 take precedence) [5]
- 19/04 • • by regulating the time of release of the firing pin or hammer [5]
- 19/05 • Synchronising for firing through the propeller of an aircraft [5]
- 19/06 • Mechanical firing mechanisms (F41A 19/01-F41A 19/05, F41A 19/59 take precedence) [5]
- 19/07 • • press-button actuated, e.g. with thumb rest [5]
- 19/08 • • remote actuated; lanyard actuated [5]
- 19/09 • • Auxiliary trigger devices (F41A 19/08 takes precedence) [5]
- 19/10 • • Triggers; Trigger mountings [5]
- 19/11 • • Trigger guards; Trigger-guard mountings (F41A 19/15 takes precedence) [5]
- 19/12 • • Sear; Sear mountings [5]
- 19/13 • • Percussion or firing pins, i.e. fixed or slidably-mounted striker elements; Mountings therefor [5]
- 19/14 • • Hammers, i.e. pivotably-mounted striker elements; Hammer mountings [5]
- 19/15 • • Modular firing mechanism units [5]
- 19/16 • • Adjustable firing mechanisms; Trigger mechanisms with adjustable trigger pull (F41A 19/17 takes precedence) [5]
- 19/17 • • Hair-trigger mechanisms [5]
- 19/18 • • for multibarrel guns (F41A 19/68 takes precedence) [5]
- 19/19 • • • with single-trigger firing possibility [5]
- 19/20 • • • • Double-trigger arrangements having the possibility of single-trigger actuation [5]
- 19/21 • • • • having only one trigger [5]
- 19/22 • • • • and only one striker element [5]
- 19/23 • • • • • rotatable about an axis parallel to the barrel axis for firing subsequent barrels [5]
- 19/24 • • Release-trigger mechanisms, i.e. the striker element being released during the return movement of the trigger subsequent to trigger pull [5]
- 19/25 • • having only slidably-mounted striker elements, i.e. percussion or firing pins [5]
- 19/26 • • • the percussion or firing pin and the breech-block or bolt forming one piece [5]
- 19/27 • • • the percussion or firing pin being movable relative to the breech-block [5]
- 19/28 • • • • propelled by a cam or lever when the breech-block or bolt arrives at a closing position [5]
- 19/29 • • • • propelled by a spring under tension [5]
- 19/30 • • • • • in bolt-action guns [5]
- 19/31 • • • • • Sear arrangements therefor (F41A 19/33 takes precedence) [5]
- 19/32 • • • • • • for catching the percussion or firing pin after each shot, i.e. in single-shot or semi-automatic firing mode [5]
- 19/33 • • • • • • Arrangements for the selection of automatic or semi-automatic fire [5]
- 19/34 • • • • • • Cocking mechanisms [5]
- 19/35 • • • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/36 • • • • • • in block-action guns [5]
- 19/37 • • • • • • Cocking mechanisms [5]
- 19/38 • • • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/39 • • • • • • Cocking mechanisms for other types of guns, e.g. fixed breech-block types, forwardly-slidable barrel types [5]
- 19/40 • • • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/41 • • • • • • • for breakdown guns [5]
- 19/42 • • • having at least one hammer [5]
- 19/43 • • • in bolt-action guns [5]
- 19/44 • • • • Sear arrangements therefor (F41A 19/46 takes precedence) [5]
- 19/45 • • • • • for catching the hammer after each shot, i.e. in single-shot or semi-automatic firing mode [5]

- 19/46 • • • • Arrangements for the selection of automatic or semi-automatic fire [5]
- 19/47 • • • • Cocking mechanisms [5]
- 19/48 • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/49 • • • • in block-action guns [5]
- 19/50 • • • • Cocking mechanisms [5]
- 19/51 • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/52 • • • • Cocking mechanisms for other types of guns, e.g. fixed breech-block types, revolvers [5]
- 19/53 • • • • • Double-action mechanisms, i.e. the cocking being effected during the first part of the trigger pull movement [5]
- 19/54 • • • • • for breakdown guns [5]
- 19/55 • • Fluid-operated firing mechanisms [5]
- 19/56 • • Ignition of the propellant charge by contact with air heated by adiabatic compression [5]
- 19/57 • Firing mechanisms operating with primer cartridge [5]
- 19/58 • Electric firing mechanisms (F41A 17/10, F41A 17/12 take precedence) [5]
- 19/59 • • Electromechanical firing mechanisms, i.e. the mechanical striker element being propelled or released by electric means [5]
- 19/60 • • characterised by the means for generating electric energy [5]
- 19/61 • • • Inductive generators [5]
- 19/62 • • • Piezo-electric generators [5]
- 19/63 • • having means for contactless transmission of electric energy, e.g. by induction, by sparking gap [5]
- 19/64 • • for automatic or burst-firing mode [5]
- 19/65 • • • for giving ripple fire, i.e. using electric sequencer switches for timed multiple-charge launching, e.g. for rocket launchers [5]
- 19/66 • • • Electronic shot-velocity control (F41A 19/65 takes precedence) [5]
- 19/67 • • • Burst limiters [5]
- 19/68 • • for multibarrel guns (F41A 19/65 takes precedence) [5]
- 19/69 • • Electric contacts or switches peculiar thereto (F41A 19/65 takes precedence) [5]
- 19/70 • • • Electric firing pins; Mountings therefor [5]
- 21/00 Barrels; Gun tubes; Muzzle attachments; Barrel mounting means** (F41A 25/00 takes precedence; barrel attachments for firing grenades or riot-control ammunition from smallarms F41C 27/06; sighting devices F41G 1/00) [5]
- 21/02 • Composite barrels, i.e. barrels having multiple layers, e.g. of different materials [5]
- 21/04 • • Barrel liners [5]
- 21/06 • Plural barrels [5]
- 21/08 • • Barrel junctions [5]
- 21/10 • Insert barrels, i.e. barrels for firing reduced calibre ammunition and being mounted within the normal barrels [5]
- 21/12 • Cartridge chambers; Chamber liners (F41A 3/74, F41A 9/46, F41A 21/04 take precedence) [5]
- 21/14 • • Arrangement of cartridge chambers lateral to the barrel axis [5]
- 21/16 • Barrels or gun tubes characterised by the shape of the bore [5]
- 21/18 • • Grooves; Rifling [5]
- 21/20 • Barrels or gun tubes characterised by the material (F41A 21/02 takes precedence) [5]
- 21/22 • Barrels which have undergone surface treatment, e.g. phosphating [5]
- 21/24 • Barrels or gun tubes with fins or ribs, e.g. for cooling [5]
- 21/26 • specially adapted for recoil reinforcement, e.g. for training purposes [5]
- 21/28 • Gas-expansion chambers; Barrels provided with gas-relieving ports (F41A 1/06, F41A 13/08 take precedence) [5]
- 21/30 • Silencers [5]
- 21/32 • Muzzle attachments or glands (F41A 21/26, F41A 21/30, F41A 21/46 take precedence) [5]
- 21/34 • • Flash dampers [5]
- 21/36 • • for recoil reduction (recoil reduction arrangements in general F41A 25/00) [5]
- 21/38 • • • adjustable [5]
- 21/40 • • Chokes for shotguns [5]
- 21/42 • • • adjustable [5]
- 21/44 • Insulation jackets; Protective jackets [5]
- 21/46 • Barrels having means for separating sabots from projectiles [5]
- 21/48 • Barrel mounting means, e.g. releasable mountings for replaceable barrels [5]
- 23/00 Gun mountings, e.g. on vehicles; Disposition of guns on vehicles** (F41A 25/00, F41A 27/00 take precedence) [5]
- 23/02 • Mountings without wheels [5]
- 23/04 • • Unipods [5]
- 23/06 • • • adjustable [5]
- 23/08 • • Bipods [5]
- 23/10 • • • adjustable [5]
- 23/12 • • Tripods [5]
- 23/14 • • • adjustable [5]
- 23/16 • • Testing mounts [5]
- 23/18 • • Rests for supporting smallarms in non-shooting position (racks for storage A47B 81/00; racks in vehicles B60R 11/00) [5]
- 23/20 • for disappearing guns [5]
- 23/22 • • on board of submarines [5]
- 23/24 • Turret gun mountings (feeding, loading or guiding ammunition F41A 9/00; mechanical elevating or traversing systems for turret guns F41A 27/18) [5]
- 23/26 • Mountings for transport only; Loading or unloading arrangements for guns for use with carrier vehicles (F41A 23/50 takes precedence) [5]
- 23/28 • Wheeled-gun mountings; Endless-track gun mountings [5]
- 23/30 • • the wheels being liftable from the ground for firing [5]
- 23/32 • • with split trails (F41A 23/30, F41A 23/46 take precedence) [5]
- 23/34 • on wheeled or endless-track vehicles [5]
- 23/36 • • on trailers (F41A 23/42 takes precedence) [5]
- 23/38 • • on motorcycles [5]
- 23/40 • • on rail vehicles [5]
- 23/42 • • for rocket throwers [5]
- 23/44 • on sledges [5]
- 23/46 • Trail spades [5]
- 23/48 • • elastic [5]
- 23/50 • Travelling locks; Brakes for holding the gun platform in a fixed position during transport [5]
- 23/52 • Base plates for gun mountings [5]
- 23/54 • • for mortars [5]

## F41A

- 23/56 • Arrangements for adjusting the gun platform in the vertical or horizontal position (F41A 17/10, F41A 17/12 take precedence) [5]
- 23/58 • • Hydraulic jacks [5]
- 23/60 • • Screw-operated jacks [5]
- 25/00 Gun mountings permitting recoil or return to battery, e.g. gun cradles; Barrel buffers or brakes (recoilless guns F41A 1/08) [5]**
- 25/02 • Fluid-operated systems [5]
- 25/04 • • adjustable [5]
- 25/06 • Friction-operated systems [5]
- 25/08 • • adjustable [5]
- 25/10 • Spring-operated systems [5]
- 25/12 • • using coil springs [5]
- 25/14 • • • adjustable [5]
- 25/16 • Hybrid systems [5]
- 25/18 • • Hydroelastic systems [5]
- 25/20 • • Hydropneumatic systems [5]
- 25/22 • Bearing arrangements for the reciprocating gun-mount or barrel movement [5]
- 25/24 • • using ball or roller bearings [5]
- 25/26 • Assembling or dismounting recoil elements or systems [5]
- 27/00 Gun mountings permitting traversing or elevating movement, e.g. gun carriages [5]**
- 27/02 • Control systems for preventing interference between the moving gun and the adjacent structure [5]
- 27/04 • Scatter-fire arrangements, i.e. means for oscillating guns automatically during firing [5]
- 27/06 • Mechanical systems (F41A 27/02, F41A 27/04, F41A 27/30 take precedence) [5]
- 27/08 • • Bearings, e.g. trunnions; Brakes or blocking arrangements [5]
- 27/10 • • • Bearings for supporting a pivoting gun in a wall, e.g. a turret wall [5]
- 27/12 • • • Brakes or locks for blocking traversing or elevating gear in a fixed position [5]
- 27/14 • • • Central-pivot bearings [5]
- 27/16 • • • using raceway bearings, e.g. for supporting the turret [5]
- 27/18 • • for gun turrets (F41A 27/08 takes precedence) [5]
- 27/20 • • • Drives for turret movements [5]
- 27/22 • • Traversing gear (F41A 27/18 takes precedence) [5]
- 27/24 • • Elevating gear (F41A 27/18 takes precedence) [5]
- 27/26 • Fluid-operated systems (F41A 27/02, F41A 27/04, F41A 27/30 take precedence) [5]
- 27/28 • Electrically-operated systems (F41A 27/02, F41A 27/04, F41A 27/30 take precedence) [5]
- 27/30 • Stabilisation or compensation systems, e.g. compensating for barrel weight or wind force [5]
- 29/00 Cleaning or lubricating arrangements (injecting fluids into barrels or cartridge chambers F41A 13/04) [5]**
- 29/02 • Scrapers or cleaning rods [5]
- 29/04 • Lubricating, oiling or greasing means, e.g. operating during use [5]
- 31/00 Testing arrangements (testing mounts F41A 23/16) [5]**
- 31/02 • for checking gun barrels [5]
- 33/00 Adaptations for training (adaptations of barrels for recoil reinforcement F41A 21/26); Gun simulators (teaching or practice apparatus for gun-aiming or gun-laying F41G 3/26) [5]**
- 33/02 • Light- or radiation-emitting guns [5]
- 33/04 • Acoustical simulation of gun fire, e.g. by pyrotechnic means [5]
- 33/06 • Recoil simulators [5]
- 35/00 Accessories or details not otherwise provided for [5]**
- 35/02 • Dust- or weather-protection caps or covers (protecting-caps for trigger guards F41A 17/54) [5]
- 35/04 • • Muzzle covers [5]
- 35/06 • Adaptation of guns to both right and left hand use [5]
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**

**F41B WEAPONS FOR PROJECTING MISSILES WITHOUT USE OF EXPLOSIVE OR COMBUSTIBLE PROPELLANT CHARGE; WEAPONS NOT OTHERWISE PROVIDED FOR** (projectiles for fishing, e.g. fish-spears, A01K 81/00; sports implements for throwing A63B 65/00, e.g. boomerangs A63B 65/08; stationary apparatus for projecting sports balls, e.g. tennis balls, A63B 69/40; throwing or slinging toys A63H 33/18, knives, axes B26B; projectiles or missiles other than those incorporating springs as projecting means F42B 6/00)

### Subclass index

BLOW GUNS.....	1/00
SLING WEAPONS.....	3/00
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THRUSTING WEAPONS, CUTTING WEAPONS CARRIED AS SIDE-ARMS.....	13/00
OTHER WEAPONS.....	15/00

**1/00 Blow guns, i.e. tubes for impelling projectiles, e.g. peas or darts, by the force of the breath (pop guns A63H)**

**3/00 Sling weapons** (throwing-apparatus for clay-pigeon or clay-disc targets F41J 9/18)

- 3/02 • Catapults, e.g. slingshots [3]
- 3/03 • • Catapults having a pivotable launcher arm [5]

3/04	• Centrifugal sling apparatus [3]	11/16	• • • having an additional slidable mass moving in the opposite direction of the piston, e.g. for recoil reduction [5]
<b>4/00</b>	<b>Friction-wheel operated launchers [5]</b>	11/18	• • • Arrangements for putting the spring under tension [5]
<b>5/00</b>	<b>Bows; Crossbows</b>	11/20	• • • • by a rocking lever [5]
5/06	• Quivers [3]	11/22	• • • • • in breakdown air guns [5]
5/10	• Compound bows [5]	11/24	• having a deformable bellows or bulb pressed during the firing [5]
5/12	• Crossbows [5]	11/26	• having precompressed air before the firing (F41B 11/06, F41B 11/08, F41B 11/32 take precedence) [5]
5/14	• Details of bows; Accessories for arc shooting (sighting devices for bows F41G 1/467) [5]	11/28	• • Pumping or compressor arrangements therefor [5]
5/16	• • Archer's finger tabs (sporting arm or hand protectors in general A41D 13/08) [5]	11/30	• • • operated by a rocking-lever system, e.g. in breakdown air guns [5]
5/18	• • Bow-string drawing or releasing devices (F41B 5/16 takes precedence) [5]	11/32	• Arrangement of valves in, or valves specially adapted for, air guns [5]
5/20	• • Bow stabilisers or vibration dampers [5]	11/34	• Sealing arrangements; Pistons [5]
5/22	• • Arrow rests or guides [5]	<b>13/00</b>	<b>Thrusting-weapons</b> (bayonets F41C 27/18); <b>Cutting-weapons carried as side-arms</b> (training appliances for fencing A63B 69/02; sheaths for hand cutting tools B26B 29/00)
<b>6/00</b>	<b>Electromagnetic launchers [5]</b>	13/02	• Sabres; Cutlasses; Swords; Epees
<b>7/00</b>	<b>Spring guns</b> (catapults F41B 3/02)	13/04	• • Sheaths or scabbards therefor
7/02	• the spring forming part of the missile or projectile	13/06	• • • for concealment, e.g. swordsticks
7/04	• adapted to discharge harpoons	13/08	• Daggers; Stilettoes
7/08	• Toy guns	13/10	• Lances; Pikes (spears for sporting purposes A63B 65/02)
<b>9/00</b>	<b>Liquid ejecting guns, e.g. water pistols</b>	<b>15/00</b>	<b>Weapons not otherwise provided for</b>
<b>11/00</b>	<b>Air guns, e.g. air pistols; Steam guns</b>	15/02	• Batons; Truncheons; Sticks; Shillelaghs
11/02	• Adaptations for feeding or loading missiles from magazines	15/04	• • with electric stunning-means
11/04	• for ejecting a powder, e.g. pepper	15/06	• • with inserted knives or spikes
11/06	• with pressure supplied by gas cartridge (F41B 11/08 takes precedence; valves therefor F41B 11/32)	15/08	• Knuckledusters
11/08	• adapted to discharge harpoons	15/10	• Bolas
11/12	• having an air piston effecting a compressor stroke during the firing of each shot [5]		
11/14	• • spring-operated [5]		
<b>F41C</b>	<b>SMALLARMS, e.g. PISTOLS, RIFLES</b> (functional features or details common to both smallarms and ordnance, mountings therefor F41A; projecting missiles without use of explosive or combustible propellant charge F41B); <b>ACCESSORIES THEREFOR [5]</b>		

**Note(s)**

Attention is drawn to the definitions in Note (2) following the title of class F41.

**Subclass index****KINDS OF SMALLARMS**

Pistols, revolvers.....	3/00
Shoulder-fired smallarms.....	7/00
Other smallarms, e.g. hidden, muzzle-loaded, underwater.....	9/00
BUTTS, BUTT PLATES, STOCKS.....	23/00
ACCESSORIES; OTHER DETAILS.....	27/00
WEARING OR CARRYING-MEANS.....	33/00

<b>3/00</b>	<b>Pistols, e.g. revolvers</b> (specially adapted for underwater use F41C 9/06; for slaughtering or stunning animals A22B; for shooting bolts into concrete constructions, metal walls or the like B25C) [3, 5]	3/12	• • with slidable cap carrier, e.g. clip (F41C 3/08 takes precedence) [5]
3/02	• Signal pistols, e.g. Very pistols	3/14	• Revolvers (F41C 3/10 takes precedence; sealing aspects F41A 3/76; using a revolving drum magazine for feeding revolver-type guns, other than revolvers, F41A 9/27; extractors or ejectors therefor F41A 15/02) [5]
3/04	• Starting pistols; Alarm pistols	3/16	• • Hinge-frame revolvers [5]
3/06	• Cap-firing pistols, e.g. toy pistols		
3/08	• • with band supply		
3/10	• • with rotatable cap carrier, e.g. drum [5]		

**F41C**

- 7/00 **Shoulder-fired smallarms, e.g. rifles, carbines, shotguns** (specially adapted for underwater use F41C 9/06) [3]
- 7/02 • Pump-action guns, i.e. guns having a reciprocating handgrip beneath the barrel for loading or cocking
- 7/04 • with reciprocating handgrip under the buttstock for loading or cocking
- 7/06 • Lever-action guns, i.e. guns having a rocking lever for loading or cocking
- 7/11 • Breakdown shotguns or rifles (hinge-frame revolvers F41C 3/16; breech mechanisms therefor F41A 3/58; cocking mechanisms therefor F41A 19/41) [5]
- 9/00 **Other smallarms, e.g. hidden smallarms or smallarms specially adapted for underwater use** [3]
- 9/02 • Concealed pistols, e.g. in pencils
- 9/04 • Walking-stick guns
- 9/06 • Smallarms specially adapted for underwater use
- 9/08 • Muzzle-loading smallarms; Smallarms with flintlock mechanisms; Accessories therefor [5]

**Details**

- 23/00 **Butts; Butt plates; Stocks**
- 23/02 • Attachment of slings
- 23/04 • Folding or telescopic stocks or stock parts (articulated or collapsible guns F41A 11/04) [5]
- 23/06 • Stocks specially adapted for recoil reduction [5]
- 23/08 • • Recoil absorbing pads [5]
- 23/10 • Stocks or grips for pistols, e.g. revolvers (F41C 23/12 takes precedence) [5]
- 23/12 • Auxiliary stocks for stabilising, or for transforming pistols, e.g. revolvers, into shoulder-fired guns [5]

- 23/14 • Adjustable stock or stock parts, i.e. adaptable to personal requirements, e.g. length, pitch, cast or drop [5]
- 23/16 • Forestocks; Handgrips; Hand guards (pump-action guns F41C 7/02) [5]
- 23/18 • characterised by the material used (F41C 23/08 takes precedence) [5]
- 23/20 • Butts; Butt plates; Mountings therefor (F41C 23/08, F41C 23/10 take precedence) [5]
- 23/22 • Stocks having space for the storage of objects [5]

**27/00 Accessories; Details or attachments not otherwise provided for**

- 27/04 • Arrangements for mounting spades or shields (spades *per se* A01B 1/02; shields *per se* F41H 5/06)
- 27/06 • Adaptations of smallarms for firing grenades, e.g. rifle grenades, or for firing riot-control ammunition; Barrel attachments therefor (signal pistols F41C 3/02)
- 27/16 • Smallarms combined with thrusting or cutting weapons (thrusting or cutting weapons, other than bayonets F41B 13/00); Bayonets; Bayonet mounts [5]
- 27/18 • • Bayonets; Bayonet mounts [5]
- 27/20 • Attachments for wire cutting [5]
- 27/22 • Balancing or stabilising arrangements [5]

**33/00 Means for wearing or carrying smallarms**

- 33/02 • Holsters, i.e. cases for pistols having means for being carried or worn, e.g. at the belt or under the arm
- 33/04 • • Special attachments therefor
- 33/06 • Containers for carrying smallarms, e.g. safety boxes, gun cases (F41C 33/02 takes precedence) [5]
- 33/08 • Handles for carrying smallarms [5]

**F41F APPARATUS FOR LAUNCHING PROJECTILES OR MISSILES FROM BARRELS, e.g. CANNONS** (smallarms F41C); **LAUNCHERS FOR ROCKETS OR TORPEDOES; HARPOON GUNS** (functional features or details common to both smallarms and ordnance, mountings therefor F41A; projecting missiles without use of explosive or combustible propellant charge F41B) [5]

**Subclass index**

LAUNCHING FROM BARRELS..... 1/00  
 ROCKET OR TORPEDO LAUNCHERS..... 3/00  
 LAUNCHING GRAVITY-PROPELLED PROJECTILES OR MISSILES..... 5/00  
 OTHER LAUNCHING APPARATUS..... 7/00

- 1/00 **Launching apparatus for projecting projectiles or missiles from barrels, e.g. cannons** (F41F 3/00 takes precedence); **Harpoon guns**
- 1/06 • Mortars (base plates therefor F41A 23/54)
- 1/08 • Multibarrel guns, e.g. twin guns [5]
- 1/10 • • Revolving-cannon guns, i.e. multibarrel guns with the barrels and their respective breeches mounted on a rotor; Breech mechanisms therefor [5]
- 3/00 **Rocket or torpedo launchers**
- 3/04 • for rockets
- 3/042 • • the launching apparatus being used also as transport container for the rocket [4]
- 3/045 • • adapted to be carried and used by a person, e.g. bazookas (F41F 3/042 takes precedence) [4]
- 3/048 • • Means for imparting spin to the rocket before launching [4]
- 3/052 • • Means for securing the rocket in the launching apparatus [4]
- 3/055 • • Umbilical connecting means [4]
- 3/058 • • Means for removing duds or misfires [4]
- 3/06 • • from aircraft
- 3/065 • • • Rocket pods, i.e. detachable containers for launching a plurality of rockets [5]
- 3/07 • • Underwater launching-apparatus [4]
- 3/073 • • Silos for rockets, e.g. mounting or sealing rockets therein (F41F 3/077 takes precedence) [5]
- 3/077 • • Doors or covers for launching tubes [5]
- 3/08 • for marine torpedoes
- 3/10 • • from below the surface of the water
- 5/00 **Launching-apparatus for gravity-propelled missiles or projectiles** (from aircraft B64D 1/04)
- 5/04 • from ships, e.g. for mines, for depth charges

7/00 **Launching-apparatus for projecting missiles or**

**projectiles otherwise than from barrels** (F41F 3/04 takes precedence) [3]

F41G **WEAPON SIGHTS; AIMING** (optical aspects thereof G02B)

- 1/00 Sighting devices** (for indirect laying of fire F41G 3/16; bombsights F41G 3/24)
- 1/01 • characterised by the visual combination effect of the respective geometrical forms of fore and rear sight (F41G 1/42 takes precedence) [5]
- 1/02 • Foresights
- 1/027 • • with lens [5]
- 1/033 • • adjustable [5]
- 1/04 • • Protection means therefor
- 1/06 • Rearsights
- 1/08 • • with aperture
- 1/10 • • with notch
- 1/12 • • with line or mark other than notch
- 1/14 • • with lens
- 1/16 • • Adjusting mechanisms therefor; Mountings therefor
- 1/17 • • • Convertible sights, i.e. sets of two or more sights brought into the sight line optionally [5]
- 1/18 • • • Clicking indicators with spring detents
- 1/20 • • • coarse and fine
- 1/22 • • • Friction clamps
- 1/24 • • • rack-and-pinion; lever; linkwork
- 1/26 • • • screw
- 1/28 • • • wedge; cam; eccentric
- 1/30 • Reflecting sights specially adapted for smallarms or ordnance (reflecting-sights in general G02B)
- 1/32 • Night sights, e.g. luminescent
- 1/34 • • combined with light source, e.g. spot light
- 1/35 • • • for illuminating the target [5]
- 1/36 • • • with infra-red light source
- 1/38 • Telescopic sights specially adapted for smallarms or ordnance (telescopic sights in general G02B); Supports or mountings therefor
- 1/387 • • Mounting telescopic sights on smallarms [5]
- 1/393 • • Mounting telescopic sights on ordnance; Transmission of sight movements to the associated gun [5]
- 1/40 • Periscopic sights specially adapted for smallarms or ordnance (periscopic sights in general G02B); Supports or mountings therefor
- 1/41 • • Mounting periscopic sights on smallarms [5]
- 1/42 • Tube sights; Bar sights
- 1/44 • Spirit-level adjusting-means, e.g. for correcting tilt
- 1/46 • for particular applications
- 1/467 • • for bows [5]
- 1/473 • • for lead-indicating or range-finding, e.g. for use with rifles or shotguns [5]
- 1/48 • • for firing grenades from rifles
- 1/50 • • for trench mortars
- 1/52 • • for rifles or shotguns having two or more barrels, or adapted to fire different kinds of ammunition, e.g. ball or shot
- 1/54 • Devices for testing or checking
- 3/00 Aiming means; Laying means** (sighting devices F41G 1/00; determining direction, distance or velocity by use of radio or other waves G01S; computers G06; aerials H01Q)
- 3/02 • using an independent line of sight
- 3/04 • for dispersing fire from a battery
- 3/06 • with rangefinder (rangefinders *per se* G01C)
- 3/08 • with means for compensating for speed, direction, temperature, pressure, or humidity of the atmosphere (measuring G01)
- 3/10 • with means for compensating for canting of the trunnions
- 3/12 • with means for compensating for muzzle velocity or powder temperature
- 3/14 • Indirect aiming means
- 3/16 • • Sighting devices adapted for indirect laying of fire
- 3/18 • • Auxiliary target devices adapted for indirect laying of fire
- 3/20 • • specially adapted for mountain artillery
- 3/22 • for vehicle-borne armament, e.g. on aircraft
- 3/24 • • Bombsights
- 3/26 • Teaching or practice apparatus for gun-aiming or gun-laying
- 3/28 • • Small-scale apparatus (relief models or maps G09B)
- 3/30 • • Gun-laying apparatus
- 3/32 • Devices for testing or checking
- 5/00 Elevating or traversing control systems for guns** (gun mountings permitting traversing or elevating movement, e.g. gun carriages, F41A 27/00; computers G06)
- 5/02 • using only mechanical means for remote control
- 5/04 • using hydraulic means for remote control
- 5/06 • using electric means for remote control
- 5/08 • Ground-based tracking-systems for aerial targets
- 5/12 • acoustically influenced
- 5/14 • for vehicle-borne guns
- 5/16 • • gyroscopically influenced
- 5/18 • • Tracking systems for guns on aircraft
- 5/20 • • for guns on ships
- 5/22 • • • to compensate for rolling or pitching
- 5/24 • • for guns on tanks
- 5/26 • Apparatus for testing or checking
- 7/00 Direction control systems for self-propelled missiles** (flight control B64C, G05D 1/00; self-propelled or guided missiles having direction control systems only installed aboard F42B 15/01; rocket torpedoes F42B 17/00; marine torpedoes or sea-mines having self-propulsion means F42B 19/00; locating by use of radio or other waves G01S; computing aspects G06)
- 7/20 • based on continuous observation of target position [3]
- 7/22 • • Homing guidance systems [3]
- 7/24 • • Beam riding guidance systems (conical-scan beam beacons therefor G01S 1/42) [3]
- 7/26 • • • Optical guidance systems [3]
- 7/28 • • • Radio guidance systems [3]
- 7/30 • • • Command link guidance systems [3]
- 7/32 • • • for wire-guided missiles [3]
- 7/34 • based on predetermined target position data [3]
- 7/36 • • using inertial references [3]
- 9/00 Systems for controlling missiles or projectiles, not provided for elsewhere**

**F41G**

9/02 • for bombing control (bombsights F41G 3/24)

**11/00 Details of sighting or aiming apparatus; Accessories**

**F41H ARMOUR; ARMoured TURRETS; ARMoured OR ARMED VEHICLES; MEANS OF ATTACK OR DEFENCE, e.g. CAMOUFLAGE, IN GENERAL**

Subclass index

ARMOUR

Personal protection gear..... 1/00  
 Armour plates, shields..... 5/00  
 CAMOUFLAGE..... 3/00  
 ARMoured OR ARMED VEHICLES..... 7/00  
 FLAME, GAS OR CHEMICAL WARFARE..... 9/00  
 OTHER ATTACK OR DEFENCE MEANS..... 11/00, 13/00

**1/00 Personal protection-gear** (shields for personal use F41H 5/08; for protection against chemical warfare A62B)

- 1/02 • Armoured or projectile- or missile-resistant garments; Composite protection fabrics
- 1/04 • Protection helmets (crash helmets A42B 3/00)
- 1/06 • • of steel; Steel head-shields
- 1/08 • • of plastics; Plastic head-shields

**3/00 Camouflage, i.e. means or methods for concealment or disguise** (for vessels B63G 8/34, B63G 13/02)

- 3/02 • Covers, e.g. screens, nets (making thereof, see the relevant classes, e.g. D04)

**5/00 Armour; Armour plates** (processes for manufacturing or treating B21, C21)

- 5/007 • Reactive armour; Dynamic armour [5]
- 5/013 • Mounting or securing armour plates [5]
- 5/02 • Plate construction
- 5/04 • • composed of more than one layer
- 5/06 • Shields (in ships B63G 9/00; in aircraft B64D 7/00)
- 5/08 • • for personal use
- 5/10 • • • Spade bayonets, i.e. usable as a spade, bayonet, or cover against rifle fire
- 5/12 • • for smallarms; for light-rocket launchers
- 5/14 • • • Wheeled armoured shields
- 5/16 • • for ordnance
- 5/18 • • Rotating shields
- 5/20 • Turrets
- 5/22 • Manhole covers, e.g. on tanks (in general F16J)
- 5/24 • for stationary use, e.g. fortifications
- 5/26 • Peepholes; Windows (manufacture or composition of glass C03); Covers therefor

**7/00 Armoured or armed vehicles** (general vehicle aspects B60; armoured or armed ships B63G; armoured or armed aircraft B64D; mounting guns, e.g. machine-guns, on vehicles F41A 23/00)

- 7/02 • Land vehicles with enclosing armour, e.g. tanks (endless-track vehicles, steering thereof B62D)
- 7/03 • • Air-pressurised compartments for crew; Means for preventing admission of noxious substances, e.g. combustion gas from gun barrels, in crew compartments; Sealing arrangements [5]
- 7/04 • • Armour construction (in general F41H 5/00)
- 7/10 • Mine-laying land vehicles

**9/00 Equipment for attack or defence by spreading flame, gas, or smoke; Chemical warfare equipment** (protection against chemicals A62B)

- 9/02 • Flame-throwing apparatus (for destroying vegetation A01M 15/00)
- 9/04 • Gas blowing apparatus, e.g. for tear gas (F41H 9/10 takes precedence)
- 9/06 • Apparatus for generating artificial fog or smoke screens (smoke-pot projectors, e.g. arranged on vehicles, F42B 5/155)
- 9/08 • • Smoke-pots without propulsive charge, i.e. stationary [5]
- 9/10 • Hand-held or body-worn self-defence devices using repellant gases or chemicals [5]

**11/00 Defence installations; Defence devices** (constructional aspects, see section E, e.g. E04H 9/04); **Means for clearing or detecting landmines**

- 11/02 • Anti-aircraft or anti-guided missile defence installations or systems (cartridges or missiles for producing smoke or for dispensing radar chaff or infra-red material F42B 5/15, F42B 12/48, F42B 12/70)
- 11/04 • • Aerial barrages
- 11/05 • Net barriers for harbour defence
- 11/06 • Gun-traps
- 11/08 • Barbed-wire obstacles; Barricades; Stanchions; Tank traps; Vehicle-impeding devices; Caltrops
- 11/10 • • Dispensing-apparatus therefor, e.g. devices for dispensing and reeling barbed wire
- 11/11 • • Clearing or neutralising barbed-wire obstacles (smallarm attachments for wire cutting F41C 27/20) [5]
- 11/12 • Means for clearing land minefields; Systems specially adapted for detection of landmines [1, 2011.01]
- 11/13 • • Systems specially adapted for detection of landmines [2011.01]
- 11/132 • • • Biological systems, e.g. with detection by animals or plants [2011.01]
- 11/134 • • • Chemical systems, e.g. with detection by vapour analysis [2011.01]
- 11/136 • • • Magnetic, electromagnetic, acoustic or radiation systems, e.g. ground penetrating radars or metal-detectors [2011.01]
- 11/138 • • • Mechanical systems, e.g. prodding sticks for manual detection [2011.01]
- 11/14 • • Explosive line charges, e.g. snakes

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| <p>11/16 • • Self-propelled mine-clearing vehicles; Mine-clearing devices attachable to vehicles [1, 2011.01]</p> <p>11/18 • • • with ground-impacting means for activating mines by the use of mechanical impulses, e.g. flails or stamping elements [2011.01]</p> <p>11/20 • • • with ground-penetrating elements, e.g. with means for removing buried landmines from the soil (F41H 11/18 takes precedence) [2011.01]</p> <p>11/22 • • • the elements being excavation buckets [2011.01]</p> <p>11/24 • • • the elements being ploughs [2011.01]</p> <p>11/26 • • • the elements being rotary ground-penetrating elements [2011.01]</p> | <p>11/28 • • • using brushing or sweeping means or dozers to push mines lying on a surface aside; using means for removing mines intact from a surface [2011.01]</p> <p>11/30 • • • with rollers creating a surface load on the ground, e.g. steadily increasing surface load, for triggering purposes [2011.01]</p> <p>11/32 • • • Decoy or sacrificial vehicles; Decoy or sacrificial devices attachable to vehicles [2011.01]</p> <p><b>13/00 Means of attack or defence not otherwise provided for</b></p> |
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## F41J TARGETS; TARGET RANGES; BULLET CATCHERS

### Subclass index

#### TARGETS

Stationary or movable.....	1/00, 7/00, 9/00
Reflecting or active.....	2/00
Specially adapted for arrows or darts.....	3/00
TARGET-HIT INDICATORS OR RECORDERS.....	5/00
TARGET STANDS; TARGET RANGES.....	1/00, 11/00
BULLET CATCHERS.....	13/00

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| <p><b>1/00 Targets; Target stands; Target holders</b> (F41J 2/00-F41J 11/00 take precedence; targets combined with bullet catchers F41J 13/02) [5]</p> <p>1/01 • Target discs characterised by their material, structure or surface (F41J 5/044 takes precedence) [5]</p> <p>1/08 • for ordnance, e.g. cannons; for attacking by aircraft; Full-scale models imitating target objects, e.g. tanks, aircraft [5]</p> <p>1/10 • Target stands; Target holders</p> <p><b>2/00 Reflecting targets, e.g. radar-reflector targets; Active targets transmitting electromagnetic waves</b> [5]</p> <p>2/02 • Active targets transmitting infra-red radiation [5]</p> <p><b>3/00 Targets for arrows or darts, e.g. for sporting or amusement purposes</b></p> <p>3/02 • Indicators or score boards for arrow or dart games</p> <p><b>5/00 Target indicating systems; Target-hit or score detecting systems</b> [5]</p> <p>5/02 • Photo-electric hit-detector systems</p> <p>5/04 • Electric hit-indicating systems; Detecting hits by actuation of electric contacts or switches [5]</p> <p>5/044 • • Targets having two or more electrically-conductive layers for short-circuiting by penetrating projectiles [5]</p> <p>5/048 • • • one of the layers being in the form of discrete target sections [5]</p> <p>5/052 • • Targets comprising a plurality of electric contacts, each corresponding to a discrete target section and being actuated by the movement thereof (F41J 5/056 takes precedence) [5]</p> <p>5/056 • • Switch actuation by hit-generated mechanical vibration of the target body, e.g. using shock or vibration transducers [5]</p> <p>5/06 • Acoustic hit-indicating systems, i.e. detecting of shock waves (F41J 5/056 takes precedence)</p> <p>5/08 • Infra-red hit-indicating systems</p> | <p>5/10 • Cinematographic hit-indicating systems (cinematographic targets F41J 9/14)</p> <p>5/12 • for indicating the distance by which a bullet misses the target (F41J 5/02-F41J 5/10 take precedence)</p> <p>5/14 • Apparatus for signalling hits or scores to the shooter, e.g. manually operated, or for communication between target and shooter; Apparatus for recording hits or scores [5]</p> <p>5/16 • • Manually evaluating scores, e.g. using scoring plugs or gauges; Apparatus for evaluating scores on targets after removal from the target holder [5]</p> <p>5/18 • Targets having hit-indicating means actuated or moved mechanically when the target has been hit, e.g. discs or flags (the target as a whole disappearing or moving when hit F41J 7/04) [5]</p> <p>5/20 • • indicating which part of the target has been hit, i.e. the score [5]</p> <p>5/22 • • the indicating means being a dispensing device [5]</p> <p>5/24 • Targets producing a particular effect when hit, e.g. detonation of pyrotechnic charge, bell ring, photograph [5]</p> <p>5/26 • • exploding or disintegrating when hit (F41J 9/16 takes precedence) [5]</p> <p><b>7/00 Movable targets which are stationary when fired at</b></p> <p>7/02 • movable for checking</p> <p>7/04 • disappearing when hit</p> <p>7/06 • Bobbing targets, i.e. targets intermittently or unexpectedly appearing [5]</p> <p><b>9/00 Moving targets, i.e. moving when fired at</b> (F41J 2/00 takes precedence) [5]</p> <p>9/02 • Land-based targets</p> <p>9/04 • Sea-going targets</p> <p>9/06 • • towed</p> <p>9/08 • Airborne targets, e.g. drones, kites, balloons</p> <p>9/10 • • towed</p> |
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## F41J

9/14	• Cinematographic targets, e.g. moving-picture targets	9/30	• • • characterised by using a magazine of targets [3]
9/16	• Clay-pigeon targets; Clay-disc targets	9/32	• • • characterised by means for obviating the anticipation of the flight path [3]
9/18	• • Traps or throwing-apparatus therefor		
9/20	• • • with spring-operated throwing arm [3]		
9/22	• • • • cocked by manual action [3]	11/00	<b>Target ranges [2009.01]</b>
9/24	• • • • cocked by electromechanical means [3]	11/02	• Safety means therefor [2009.01]
9/26	• • • operated by fluid means [3]	13/00	<b>Bullet catchers [2009.01]</b>
9/28	• • • operated by manual action [3]	13/02	• combined with targets [2009.01]

## F42 AMMUNITION; BLASTING

### Note(s)

1. This class covers also means for practice or training which may have aspects of simulation, although simulators are generally covered by class G09.
2. In this class, the following terms or expressions are used with the meanings indicated:
  - "primer" effects the first explosive step in the sequence of explosion;
  - "percussion cap" means a primer which is struck to explode;
  - "igniter" effects the first spark-producing or heat-producing step but may not be explosive;
  - "firing-means" or "initiator" (used respectively in the arts of weaponry and blasting) means a device acting directly on the primer, which device may or may not form part of the fuze;
  - "detonator" or "detonator charge" means a charge used to amplify the explosion of the primer;
  - "fuze" means an assembly or mechanism which incorporates safety and arming means in order that the explosion can only take place under certain conditions; this assembly or mechanism determines also the moment (instantaneous or delayed) or the manner, e.g. impact, proximity, hydrostatic pressure, of the firing;
  - "ammunition" covers propulsive charge and projectile whether or not forming a single body, unless otherwise made clear;
  - "projectile", "missile" or "projectile or missile" means any body which is projected or propelled;
  - "guided missile" means projectile or missile which is guided during at least part of its trajectory;
  - "rocket" means projectile or missile which is self-propelled, during at least part of its trajectory, by a rocket engine, i.e. by a jet-propulsion engine carrying both fuel and oxidant therefor;
  - "fuse" or "fuse cord" means a continuous train of explosive enclosed in a usually flexible cord or cable for setting-off an explosive charge in the art of blasting.

**F42B EXPLOSIVE CHARGES, e.g. FOR BLASTING; FIREWORKS; AMMUNITION** (explosive compositions C06B; fuzes F42C; blasting F42D) [2, 5]

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**1/00 Explosive charges characterised by form or shape but not dependent on shape of container**

- 1/02 • Shaped or hollow charges (blasting cartridges with cavities in the charge F42B 3/08; oil-winning using shaped-charge perforators E21B 43/116)
- 1/024 • • provided with embedded bodies of inert material [5]
- 1/028 • • characterised by the form of the liner [5]
- 1/032 • • characterised by the material of the liner [5]
- 1/036 • • Manufacturing processes therefor [5]
- 1/04 • Detonator charges not forming part of the fuze

**3/00 Blasting cartridges, i.e. case and explosive** (fuse cords, e.g. detonating fuse cords, C06C 5/00; chemical aspects of detonators, blasting caps or primers C06C 7/00)

- 3/02 • adapted to be united into assemblies
- 3/04 • for producing gas under pressure
- 3/06 • • with re-utilisable case
- 3/08 • with cavities in the charge, e.g. hollow-charge blasting cartridges
- 3/087 • Flexible or deformable blasting cartridges, e.g. bags or hoses (loaded cartridge bags F42B 5/38) [5]
- 3/093 • • in mat or tape form [5]
- 3/10 • Initiators therefor (percussion fuzes F42C 7/00; percussion caps F42C 19/10; electric primers F42C 19/12)

**Note(s)**

Group F42B 3/18 takes precedence over groups F42B 3/103-F42B 3/16.

- 3/103 • • Mounting initiator heads in initiators; Sealing-plugs [5]
- 3/107 • • Sealing-plugs characterised by the material used [5]
- 3/11 • • characterised by the material used, e.g. for initiator case or electric leads (F42B 3/107 takes precedence) [5]
- 3/113 • • activated by optical means, e.g. laser, flashlight [5]
- 3/117 • • activated by friction [5]
- 3/12 • • Bridge initiators
- 3/13 • • • with semiconductive bridge [5]
- 3/14 • • Spark initiators
- 3/16 • • Delay initiators
- 3/18 • • Safety initiators resistant to premature firing by static electricity or stray currents
- 3/182 • • • having shunting means [5]
- 3/185 • • • having semiconductive sealing plugs [5]
- 3/188 • • • having radio-frequency filters [5]
- 3/192 • • designed for neutralisation on contact with water [5]
- 3/195 • • Manufacture [5]
- 3/198 • • • of electric initiator heads [5]
- 3/22 • Elements for controlling or guiding the detonation wave, e.g. tubes (using inert bodies embedded in shaped or hollow charges F42B 1/024) [5]
- 3/24 • Cartridge closures or seals (top closures for shotgun ammunition cartridges F42B 7/12) [5]
- 3/26 • Arrangements for mounting initiators; Accessories therefor, e.g. tools [5]
- 3/28 • Cartridge cases characterised by the material used, e.g. coatings (for initiator cases F42B 3/11) [5]

**4/00 Fireworks, i.e. pyrotechnic devices for amusement, display, illumination, or signal purposes** (signalling by explosives G08B; advertising by firework G09F 13/46) [2]

- 4/02 • in cartridge form, i.e. shell, propellant, and primer [2]
- 4/04 • Firecrackers [2]
- 4/06 • Aerial display rockets (rockets in general F42B 15/00) [2]
- 4/08 • • characterised by having vanes, wings, parachutes, or balloons [2]
- 4/10 • • characterised by having means to separate article or charge from casing without destroying casing [2]
- 4/12 • • • Parachute or flare separation [2]
- 4/14 • • characterised by having plural successively-ignited charges [2]
- 4/16 • Hand-thrown impact-exploded noise makers (cap pistols F41C 3/06) [4]
- 4/18 • Simulations, e.g. pine cone, house that is destroyed, warship, volcano [2]
- 4/20 • characterised by having holder or support other than casing, e.g. whirler or spike support [2]
- 4/22 • characterised by having means to separate an article or charge from casing without destroying casing (in aerial display rockets F42B 4/10) [2]
- 4/24 • characterised by having plural successively-ignited charges (in aerial display rockets F42B 4/14) [2]
- 4/26 • Flares; Torches [2]
- 4/28 • • Parachute flares (F42B 4/12 takes precedence) [2]
- 4/30 • Manufacture [2]

**5/00 Cartridge ammunition, e.g. separately-loaded propellant charges** (shotgun ammunition F42B 7/00; practice or training ammunition F42B 8/00; missiles therefor F42B 12/00, F42B 14/00, F42B 15/00)

- 5/02 • Cartridges, i.e. cases with propellant charge and missile
- 5/03 • • containing more than one missile [4]
- 5/045 • • of telescopic type (F42B 5/184 takes precedence) [5]
- 5/05 • • for recoilless guns (recoilless guns using a counter-projectile to balance recoil F41A 1/10) [4]
- 5/067 • • Mounting or locking missiles in cartridge cases (F42B 5/18 takes precedence) [5]
- 5/073 • • • using an auxiliary locking element [5]
- 5/08 • • modified for electric ignition
- 5/10 • • with self-propelled bullet
- 5/14 • • for marking cattle
- 5/145 • • for dispensing gases, vapours, powders, particles or chemically-reactive substances (from projectiles F42B 12/46, F42B 12/70) [5]
- 5/15 • • • for creating a screening or decoy effect, e.g. using radar chaff or infra-red material (infra-red flares F42B 4/26) [5]
- 5/155 • • • • Smoke-pot projectors, e.g. arranged on vehicles [5]
- 5/16 • • characterised by composition or physical dimensions or form of propellant charge or powder (chemical composition C06B)
- 5/18 • • Caseless ammunition; Cartridges having combustible cases [5]
- 5/184 • • • telescopic [5]
- 5/188 • • • Manufacturing processes therefor [5]

**F42B**

- 5/192 • • • Cartridge cases characterised by the material used [5]
- 5/196 • • • • Coatings [5]
- 5/24 • • for cleaning; for cooling; for lubricating [5]
- 5/26 • Cartridge cases (F42B 5/18 takes precedence)
- 5/28 • • of metal
- 5/285 • • • formed by assembling several elements [4]
- 5/29 • • • • wound from sheets or strips [4]
- 5/295 • • • coated [4]
- 5/297 • • • • with plastics [5]
- 5/30 • • of plastics
- 5/307 • • • formed by assembling several elements [4]
- 5/313 • • • • all elements made of plastics [4]
- 5/32 • • for rim fire
- 5/34 • • with provision for varying the length
- 5/36 • • modified for housing an integral firing-cap
- 5/38 • Separately-loaded propellant charges, e.g. cartridge bags [4]

**6/00 Projectiles or missiles specially adapted for projection without use of explosive or combustible propellant charge, e.g. for blow guns, bows or crossbows, hand-held spring or air guns** (for delivering hypodermic charges F42B 12/54; throwing-darts A63B 65/02; projectiles or missiles incorporating springs as the projecting means F41B 7/02) [5]

- 6/02 • Arrows; Crossbow bolts; Harpoons for hand-held spring or air guns [5]
- 6/04 • • Archery arrows (F42B 6/08, F41B 5/06 take precedence) [5]
- 6/06 • • • Tail ends, e.g. nocks, fletching [5]
- 6/08 • • Arrow heads; Harpoon heads [5]
- 6/10 • Air gun pellets [5]

**7/00 Shotgun ammunition**

- 7/02 • Cartridges, i.e. cases with propellant charge and missile
- 7/04 • • of pellet type
- 7/06 • • with cartridge case of plastics
- 7/08 • • Wads therefor
- 7/10 • • Ball or slug shotgun cartridges
- 7/12 • • Cartridge top closures, i.e. for the missile side (closures for blasting cartridges F42B 3/24) [5]

**8/00 Practice or training ammunition** (range-reducing, destabilising or braking arrangements F42B 10/00; with signalling effect F42B 12/02; F42B 19/00 takes precedence) [4]

- 8/02 • Cartridges [5]
- 8/04 • • Blank cartridges, i.e. primed cartridges without projectile but containing an explosive or combustible powder charge [5]
- 8/06 • • • for cap-firing pistols [5]
- 8/08 • • Dummy cartridges, i.e. inert cartridges containing neither primer nor explosive or combustible powder charge [5]
- 8/10 • • with sub-calibre adaptor [5]
- 8/12 • Projectiles or missiles (F42B 19/36 takes precedence) [5]
- 8/14 • • disintegrating in flight or upon impact [5]
- 8/16 • • • containing an inert filler in powder or granular form [5]

**Note(s)**

Group F42B 8/14 takes precedence over groups F42B 8/18-F42B 8/26.

- 8/18 • • Rifle grenades [5]
- 8/20 • • Mortar grenades [5]
- 8/22 • • Fall bombs [5]
- 8/24 • • Rockets [5]
- 8/26 • • Hand grenades [5]
- 8/28 • Land or marine mines; Depth charges [5]

**10/00 Means for influencing, e.g. improving, the aerodynamic properties of projectiles or missiles; Arrangements on projectiles or missiles for stabilising, steering, range-reducing, range-increasing or fall-retarding** (F42B 6/00 takes precedence; sub-calibre projectiles having sabots F42B 14/00) [5]

- 10/02 • Stabilising arrangements [5]
- 10/04 • • using fixed fins (F42B 10/22 takes precedence) [5]
- 10/06 • • • Tail fins [5]
- 10/08 • • • • Flechette-type projectiles [5]
- 10/10 • • • • the fins being formed in the barrel by deformation of the projectile body [5]
- 10/12 • • using fins longitudinally-slidable with respect to the projectile or missile [5]
- 10/14 • • using fins spread or deployed after launch, e.g. after leaving the barrel [5]
- 10/16 • • • Wrap-around fins [5]
- 10/18 • • • using a longitudinally slidable support member [5]
- 10/20 • • • deployed by combustion gas pressure, or by pneumatic or hydraulic forces [5]
- 10/22 • • Projectiles of cannellured type [5]
- 10/24 • • • with inclined grooves [5]
- 10/26 • • using spin (F42B 10/04, F42B 10/12, F42B 10/14, F42B 10/24, F42B 14/02 take precedence) [5]
- 10/28 • • • induced by gas action [5]
- 10/30 • • • • using rocket motor nozzles [5]
- 10/32 • Range-reducing or range-increasing arrangements; Fall-retarding means [5]
- 10/34 • • Tubular projectiles [5]
- 10/36 • • • Ring-foil projectiles [5]
- 10/38 • • Range-increasing arrangements (F42B 10/34 takes precedence) [5]
- 10/40 • • • with combustion of a slow-burning charge, e.g. fumers, base-bleed projectiles [5]
- 10/42 • • • Streamlined projectiles [5]
- 10/44 • • • • Boat-tails specially adapted for drag reduction [5]
- 10/46 • • • • Streamlined nose cones; Windshields; Radomes [5]
- 10/48 • • Range-reducing, destabilising or braking arrangements; Fall-retarding means (F42B 10/34 takes precedence) [5]
- 10/50 • • • Brake flaps [5]
- 10/52 • • • Nose cones [5]
- 10/54 • • • Spin braking means [5]
- 10/56 • • • of parachute type [5]
- 10/58 • • • of rotochute type [5]
- 10/60 • Steering arrangements (F42B 19/01 takes precedence) [5]
- 10/62 • • Steering by movement of flight surfaces [5]
- 10/64 • • • of fins [5]
- 10/66 • • Steering by varying intensity or direction of thrust (thrust vector control of rocket engine plants F02K 9/80) [5]

- 12/00 Projectiles, missiles or mines characterised by the warhead, the intended effect, or the material** (F42B 6/00, F42B 10/00, F42B 14/00 take precedence; for practice or training F42B 8/12, F42B 8/28; self-propulsion or guidance aspects F42B 15/00) [5]
- 12/02 • characterised by the warhead or the intended effect [5]
- 12/04 • • of armour-piercing type [5]
- 12/06 • • • with hard or heavy core; Kinetic energy penetrators (F42B 12/16, F42B 12/74 take precedence) [5]
- 12/08 • • • with armour-piercing caps; with armoured cupola [5]
- 12/10 • • • with shaped or hollow charge (shaped or hollow charges per se F42B 1/02) [5]
- 12/12 • • • • rotatably mounted with respect to missile housing [5]
- 12/14 • • • • the symmetry axis of the hollow charge forming an angle with the longitudinal axis of the projectile [5]
- 12/16 • • • • in combination with an additional projectile or charge, acting successively on the target [5]
- 12/18 • • • • • Hollow charges in tandem arrangement [5]
- 12/20 • • of high-explosive type (F42B 12/44 takes precedence) [5]
- 12/22 • • • with fragmentation-hull construction [5]
- 12/24 • • • • with grooves, recesses or other wall weakenings [5]
- 12/26 • • • • the projectile wall being formed by a spirally-wound element [5]
- 12/28 • • • • the projectile wall being built from annular elements [5]
- 12/30 • • • • Continuous-rod warheads [5]
- 12/32 • • • • the hull or case comprising a plurality of discrete bodies, e.g. steel balls, embedded therein [5]
- 12/34 • • expanding before or on impact, i.e. of dum-dum or mushroom type [5]
- 12/36 • • for dispensing materials; for producing chemical or physical reaction; for signalling [5]
- 12/38 • • • of tracer type [5]
- 12/40 • • • of target-marking, i.e. impact-indicating, type (F42B 12/48 takes precedence) [5]
- 12/42 • • • of illuminating type, e.g. carrying flares [5]
- 12/44 • • • of incendiary type (F42B 12/46 takes precedence) [5]
- 12/46 • • • for dispensing gases, vapours, powders or chemically-reactive substances (F42B 12/70 takes precedence) [5]
- 12/48 • • • • smoke-producing [5]
- 12/50 • • • • by dispersion [5]
- 12/52 • • • • • Fuel-air explosive devices [5]
- 12/54 • • • • • by implantation, e.g. hypodermic projectiles [5]
- 12/56 • • • for dispensing discrete solid bodies (F42B 12/70 takes precedence) [5]
- 12/58 • • • • Cluster or cargo ammunition, i.e. projectiles containing one or more submissiles (F42B 12/32 takes precedence) [5]
- 12/60 • • • • • the submissiles being ejected radially [5]
- 12/62 • • • • • the submissiles being ejected parallel to the longitudinal axis of the projectile [5]
- 12/64 • • • • • • the submissiles being of shot- or flechette-type [5]
- 12/66 • • • • • Chain-shot, i.e. the submissiles being interconnected by chains or the like [5]
- 12/68 • • • • Line-carrying missiles, e.g. for life-saving (harpoons F42B 30/14) [5]
- 12/70 • • • • for dispensing radar chaff or infra-red material (radar-reflector targets, active targets transmitting infra-red radiation F41J 2/00; radar-reflecting surfaces H01Q 15/14) [5]
- 12/72 • characterised by the material (heat treatment for explosive shells C21D 9/16) [5]
- 12/74 • • of the core or solid body [5]
- 12/76 • • of the casing [5]
- 12/78 • • • of jackets for smallarm bullets [5]
- 12/80 • • • Coatings [5]
- 12/82 • • • • reduction friction [5]
- 14/00 Projectiles or missiles characterised by arrangements for guiding or sealing them inside barrels, or for lubricating or cleaning barrels [5]**
- 14/02 • Driving bands; Rotating bands (F42B 14/04 takes precedence) [5]
- 14/04 • Lubrication means in missiles (coatings for reducing friction F42B 12/82) [5]
- 14/06 • Sub-calibre projectiles having sabots; Sabots therefor [5]
- 14/08 • • Sabots filled with propulsive charges; Removing sabots by combustion of pyrotechnic elements or by propulsive-gas pressure (arrangements on barrels for removing sabots from projectiles F41A 21/46) [5]
- 15/00 Self-propelled projectiles or missiles, e.g. rockets; Guided missiles** (F42B 10/00, F42B 12/00, F42B 14/00 take precedence; for practice or training F42B 8/12; rocket torpedoes F42B 17/00; marine torpedoes F42B 19/00; cosmonautic vehicles B64G; jet-propulsion plants F02K) [4]
- 15/01 • Arrangements thereon for guidance or control (aircraft flight control B64C; guidance systems other than those only installed aboard F41G 7/00, F41G 9/00; locating by use of radio or other waves G01S; flight control in general G05D 1/00; computing aspects G06) [5]
- 15/04 • • using wire, e.g. for guiding ground-to-ground rockets
- 15/08 • for carrying measuring instruments (adaptations for meteorology G01W 1/08)
- 15/10 • Missiles having a trajectory only in the air
- 15/12 • • Intercontinental ballistic missiles (F42B 15/01 takes precedence) [4]
- 15/20 • Missiles having a trajectory beginning below water surface (having additional propulsion means for movement through water F42B 17/00)
- 15/22 • Missiles having a trajectory finishing below water surface (having additional propulsion means for movement through water F42B 17/00)
- 15/34 • Protection against overheating or radiation, e.g. heat shields; Additional cooling arrangements [5]
- 15/36 • Means for interconnecting rocket-motor and body section; Multi-stage connectors; Disconnecting means [5]
- 15/38 • • Ring-shaped explosive elements for the separation of rocket parts [5]
- 17/00 Rocket torpedoes, i.e. missiles provided with separate propulsion means for movement through air and through water** (F42B 12/00 takes precedence)

- 19/00 Marine torpedoes, e.g. launched by surface vessels or submarines** (having additional propulsion means for movement through air F42B 17/00); **Sea mines having self-propulsion means** (F42B 12/00 takes precedence; launching means F41F; locating by use of radio or other waves G01S; automatic control of course G05D 1/00; firing directors or calculators G06G)
- 19/01 • Steering control
  - 19/04 • • Depth control
  - 19/06 • • Directional control
  - 19/08 • • with means for preventing rolling or pitching
  - 19/10 • • remotely controlled, e.g. by sonic or radio control (control systems using wire F41G 7/32)
  - 19/12 • Propulsion specially adapted for torpedoes (marine propulsion in general B63H)
    - 19/14 • • by compressed-gas motors
    - 19/16 • • • of cylinder type
    - 19/18 • • • of turbine type
    - 19/20 • • • characterised by the composition of propulsive gas; Manufacture or heating thereof in torpedoes
      - 19/22 • • by internal-combustion engines
      - 19/24 • • by electric motors
      - 19/26 • • by jet propulsion
      - 19/28 • • with means for avoiding visible wake
      - 19/30 • • with timing control of propulsion
      - 19/36 • adapted to be used for exercise purposes, e.g. indicating position or course
      - 19/38 • • with means for causing torpedoes to surface at end of run
        - 19/40 • • • by expelling liquid ballast
        - 19/42 • • • by releasing solid ballast
        - 19/44 • • • by enlarging displacement
        - 19/46 • adapted to be launched from aircraft
- 21/00 Depth charges** (F42B 12/00 takes precedence; for practice or training F42B 8/28; laying aspects B63G)
- 22/00 Marine mines, e.g. launched by surface vessels or submarines** (F42B 12/00 takes precedence; for practice or training F42B 8/28; mine laying or sweeping B63G)
- 22/02 • Contact mines (contact fuzes F42C 7/02)
  - 22/04 • Influenced mines, e.g. by magnetic or acoustic effect
  - 22/06 • Ground mines
  - 22/08 • Drifting mines (with propulsion means F42B 19/00)
  - 22/10 • Moored mines
    - 22/12 • • at a fixed depth setting
    - 22/14 • • at a variable depth setting
    - 22/16 • • • using mechanical means, e.g. plummet and float
      - 22/18 • • • using hydrostatic means
      - 22/20 • • • using magnetic or acoustic depth-control means
    - 22/22 • having self-contained sinking means
    - 22/24 • Arrangement of mines in fields or barriers (net barriers for harbour defence F41H 11/05)
    - 22/42 • with anti-sweeping means, e.g. electrical
    - 22/44 • adapted to be launched from aircraft
- 23/00 Land mines** (F42B 12/00 takes precedence; for practice or training F42B 8/28)
- 23/04 • anti-vehicle [5]
  - 23/08 • • non-metallic [5]
  - 23/10 • anti-personnel [5]
  - 23/14 • • non-metallic [5]
- 23/16 • • of missile type, i.e. for detonation after ejection from ground (fuzes for initiating mine ejection F42C 1/09) [5]
  - 23/24 • Details
- 25/00 Fall bombs** (F42B 10/00, F42B 12/00 take precedence; for practice or training F42B 8/12) [5]
- 27/00 Hand grenades** (F42B 12/00 takes precedence; for practice or training F42B 8/12)
- 27/08 • with handle
- 29/00 Noiseless, smokeless, or flashless missiles launched by their own explosive propellant**
- 30/00 Projectiles or missiles, not otherwise provided for, characterised by the ammunition class or type, e.g. by the launching apparatus or weapon used** (F42B 10/00, F42B 12/00, F42B 14/00 take precedence) [5]
- 30/02 • Bullets [5]
  - 30/04 • Rifle grenades [5]
  - 30/06 • • Bullet traps or bullet decelerators therefor [5]
  - 30/08 • Ordnance projectiles or missiles, e.g. shells [5]
  - 30/10 • • Mortar projectiles [5]
  - 30/12 • • • with provision for additional propulsive charges, or for varying the length [5]
  - 30/14 • Harpoons (for hand-held spring or air guns F42B 6/02) [5]
- 33/00 Manufacture of ammunition; Dismantling of ammunition; Apparatus therefor** (F42B 5/188 takes precedence; manufacturing processes for hollow charges F42B 1/036; manufacturing of blasting cartridge initiators F42B 3/195)
- 33/02 • Filling cartridges, missiles, or fuzes; Inserting propellant or explosive charges
  - 33/04 • Fitting or extracting primers in or from fuzes or charges
  - 33/06 • Dismantling fuzes, cartridges, projectiles, missiles, rockets, or bombs (F42B 33/04 takes precedence)
  - 33/10 • Reconditioning used cartridge cases
  - 33/12 • Crimping shotgun cartridges
  - 33/14 • Surface treatment of cartridges or cartridge cases
- 35/00 Testing or checking of ammunition**
- 35/02 • Gauging, sorting, trimming or shortening cartridges or missiles
- 39/00 Packaging or storage of ammunition or explosive charges; Safety features thereof; Cartridge belts or bags**
- 39/02 • Cartridge bags; Bandoleers
  - 39/08 • Cartridge belts
  - 39/10 • • Machines for charging or for extracting cartridges from feed belts
  - 39/14 • Explosion or fire protection arrangements on packages or ammunition (F42B 39/20 takes precedence) [5]
    - 39/16 • • Fire-extinguishing [5]
    - 39/18 • • Heat shields; Thermal insulation [5]
  - 39/20 • Packages or ammunition having valves for pressure-equalising; Packages or ammunition having plugs for pressure release, e.g. meltable [5]
  - 39/22 • Locking of ammunition in transport containers [5]
  - 39/24 • Shock-absorbing arrangements in packages [5]

- 39/26 • Packages or containers for a plurality of ammunition, e.g. cartridges (F42B 39/14-F42B 39/24, F42B 39/28 take precedence) [5]
- 39/28 • Ammunition racks, e.g. in vehicles [5]
- 39/30 • Containers for detonators or fuzes (F42B 39/14, F42B 39/20 take precedence) [5]
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**

**F42C AMMUNITION FUZES** (blasting cartridge initiators F42B 3/10; chemical aspects C06C); **ARMING OR SAFETY MEANS THEREFOR** (filling fuzes F42B 33/02; fitting or extracting primers in or from fuzes F42B 33/04; containers for fuzes F42B 39/30) [5]

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- |  |  |
|--|--|
| <b>1/00 Impact fuzes, i.e. fuzes actuated only by ammunition impact</b>  | 7/10 • • of antenna type [5]   |
| 1/02 • with firing pin structurally combined with fuze   | 7/12 • Percussion fuzes of the double-action type, i.e. fuzes cocked and fired in a single movement, e.g. by pulling an incorporated percussion pin or hammer (percussion caps F42C 19/10) [5] |
| 1/04 • • operating by inertia of members on impact   |  |
| 1/06 • • • for any direction of impact   |  |
| 1/08 • • with delayed action after ignition of fuze (time fuzes F42C 9/00)   | <b>9/00 Time fuzes; Combined time- and percussion- or pressure-actuated fuzes; Fuzes for timed self-destruction of ammunition</b>  |
| 1/09 • • the fuze activating a propulsive charge for propelling the ammunition or the warhead into the air, e.g. in rebounding projectiles [5]   | 9/02 • the timing being caused by mechanical means   |
| 1/10 • without firing pin  | 9/04 • • by spring motor   |
| 1/12 • • with delayed action after ignition of fuze (time fuzes F42C 9/00)   | 9/06 • • by flow of fluent material, e.g. shot, fluids   |
| 1/14 • operating at a predetermined distance from ground or target by means of a protruding member   | 9/08 • the timing being caused by chemical action, e.g. of acids   |
| <b>3/00 Fuzes actuated by exposure to a liquid, e.g. sea-water</b> (F42C 5/00 takes precedence; time fuzes F42C 9/00)  | 9/10 • the timing being caused by combustion   |
| <b>5/00 Fuzes actuated by exposure to a predetermined ambient fluid pressure</b>   | 9/12 • • with ring combustion elements   |
| 5/02 • barometric pressure   | 9/14 • Double fuzes; Multiple fuzes  |
| <b>7/00 Fuzes actuated by application of a predetermined mechanical force, e.g. tension, torsion, pressure</b> (by ammunition impact F42C 1/00; by exposure to a predetermined ambient fluid pressure F42C 5/00) | 9/16 • • for self-destruction of ammunition  |
| 7/02 • Contact fuzes, i.e. fuzes actuated by mechanical contact between a stationary ammunition, e.g. a land mine, and a moving target, e.g. a person (F42C 7/12 takes precedence)                               | 9/18 • • • when the spin rate falls below a predetermined limit, e.g. a spring force being stronger than the locking action of a centrifugally-operated lock [5]                               |
| 7/04 • • actuated by applying pressure on the ammunition head [5]  | <b>11/00 Electric fuzes</b> (proximity fuzes F42C 13/00; electric igniters F42C 19/12)   |
| 7/06 • • • and comprising pneumatic or hydraulic retarding means [5]   | 11/02 • with piezo-crystal   |
| 7/08 • • of release type, i.e. actuated by releasing pressure from the ammunition head [5]   | 11/04 • with current induction   |
|  | 11/06 • with time delay by electric circuitry  |
|  | <b>13/00 Proximity fuzes; Fuzes for remote detonation</b>  |
|  | 13/02 • operated by intensity of light or similar radiation  |
|  | 13/04 • operated by radio waves  |
|  | 13/06 • operated by sound waves  |
|  | 13/08 • operated by variations in magnetic field   |

## F42C

- 14/00 Fuzes characterised by the ammunition class or type** (F42C 1/00, F42C 13/00, F42C 15/00 take precedence) [5]
- 14/02 • for hand grenades [5]
  - 14/04 • for torpedoes, marine mines or depth charges (influenced marine mines F42B 22/04) [5]
  - 14/06 • for fall bombs [5]
  - 14/08 • for land mines [5]
- 15/00 Arming-means in fuzes; Safety means for preventing premature detonation of fuzes or charges**
- 15/16 • wherein the firing pin is displaced out of the action line for safety (F42C 15/40 takes precedence)
  - 15/18 • wherein a carrier for an element of the pyrotechnic or explosive train is moved (F42C 15/40 takes precedence) [5]
  - 15/184 • • using a slidable carrier [5]
  - 15/188 • • using a rotatable carrier [5]
  - 15/192 • • • rotatable in a plane which is parallel to the longitudinal axis of the projectile [5]
  - 15/196 • • • by the action of centrifugal or inertia forces on the carrier body, e.g. the carrier having eccentrically mounted weights or eccentric centre of gravity [5]
  - 15/20 • wherein a securing-pin or latch is removed to arm the fuze, e.g. removed from the firing pin (F42C 15/40 takes precedence)
  - 15/21 • • using spring action (F42C 15/23 takes precedence) [5]
  - 15/22 • • using centrifugal force (F42C 15/23 takes precedence)
  - 15/23 • • by unwinding a flexible ribbon or tape [5]
  - 15/24 • wherein the safety or arming action is effected by inertia means (F42C 15/196, F42C 15/20 take precedence)
  - 15/26 • • using centrifugal force
  - 15/28 • operated by flow of fluent material, e.g. shot, fluids (F42C 15/26 takes precedence)
  - 15/285 • • stored within the fuze housing [5]
  - 15/29 • • operated by fluidic oscillators; operated by dynamic fluid pressure, e.g. ram-air operated [5]
  - 15/295 • • operated by a turbine or a propeller; Mounting means therefor [5]
  - 15/30 • • of propellant gases, i.e. derived from propulsive charge or rocket motor
- 15/31 • • generated by the combustion of a pyrotechnic or explosive charge within the fuze [5]
  - 15/32 • operated by change of fluid pressure (F42C 5/00, F42C 15/29 take precedence)
  - 15/33 • • by breaking a vacuum or pressure container [5]
  - 15/34 • wherein the safety or arming action is effected by a blocking-member in the pyrotechnic or explosive train between primer and main charge (F42C 15/18, F42C 15/40 take precedence)
  - 15/36 • wherein arming is effected by combustion or fusion of an element (F42C 15/31 takes precedence)
  - 15/38 • wherein arming is effected by chemical action (F42C 3/00 takes precedence)
  - 15/40 • wherein the safety or arming action is effected electrically
  - 15/42 • • from a remote location, e.g. for controlled mines or mine fields [5]
  - 15/44 • Arrangements for disarming, or for rendering harmless, fuzes after arming, e.g. after launch [5]
- 17/00 Fuze-setting apparatus**
- 17/02 • Fuze-setting keys
  - 17/04 • for electric fuzes [5]
- 19/00 Details of fuzes** (other parts F42C 15/00)
- 19/02 • Fuze bodies; Fuze housings
  - 19/04 • Protective caps
  - 19/06 • Electric contact parts specially adapted for use with electric fuzes
  - 19/07 • • Nose-contacts for projectiles or missiles [5]
  - 19/08 • Primers (initiators for blasting cartridges F42B 3/10); Detonators
  - 19/085 • • Primers for caseless ammunition [5]
  - 19/09 • • Primers or detonators containing a hollow charge [5]
  - 19/095 • • Arrangement of a multiplicity of primers or detonators, dispersed around a warhead, one of the primers or detonators being selected for directional detonation effects [5]
  - 19/10 • • Percussion caps
  - 19/12 • • electric
  - 19/14 • • • operable also in the percussion mode [5]
- 21/00 Checking fuzes; Testing fuzes**
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**

## F42D BLASTING (fuses, e.g. fuse cords, C06C 5/00; blasting cartridges F42B 3/00)

- 1/00 Blasting methods or apparatus, e.g. for loading or tamping**
- 1/02 • Arranging blasting cartridges to form an assembly (adaptation of blasting cartridges therefor F42B 3/02)
  - 1/04 • Arrangements for ignition
  - 1/045 • • Arrangements for electric ignition (dynamo-electric generators H02K) [5]
  - 1/05 • • • Electric circuits for blasting [5]
  - 1/055 • • • specially adapted for firing multiple charges with a time delay [5]
  - 1/06 • • Relative timing of multiple charges (F42D 1/055 takes precedence)
  - 1/08 • Tamping methods; Methods for loading boreholes with explosives; Apparatus therefor [5]
- 1/10 • • Feeding explosives in granular or slurry form; Feeding explosives by pneumatic or hydraulic pressure [5]
  - 1/12 • • Feeding tamping material by pneumatic or hydraulic pressure [5]
  - 1/14 • • Hand-operated tamping or loading [5]
  - 1/16 • • • Tamping tools [5]
  - 1/18 • • Plugs for boreholes [5]
  - 1/20 • • Tamping cartridges, i.e. cartridges containing tamping material (flexible or deformable blasting cartridges F42B 3/087) [5]
  - 1/22 • • Means for holding or positioning blasting cartridges or tamping cartridges in boreholes [5]
  - 1/24 • • characterised by the tamping material [5]
  - 1/26 • • • Tamping with foaming agents [5]

1/28 • • • Tamping with gelling agents [5]

**3/00 Particular applications of blasting techniques**

3/02 • for demolition of tall structures, e.g. chimney stacks

3/04 • for rock blasting

3/06 • for seismic purposes

**5/00 Safety arrangements**

5/02 • Locating undetonated charges

5/04 • Rendering explosive charges harmless, e.g. destroying ammunition (extracting primers, dismantling ammunition F42B 33/04, F42B 33/06); Rendering detonation of explosive charges harmless [5]

5/045 • • Detonation-wave absorbing or damping means [5]

5/05 • • • Blasting mats [5]

5/055 • • Silencing means for blasting operations (F42D 5/045 takes precedence) [5]

5/06 • Unloading boreholes

**99/00 Subject matter not provided for in other groups of this subclass [2009.01]**

**F99 SUBJECT MATTER NOT OTHERWISE PROVIDED FOR IN THIS SECTION**

**F99Z SUBJECT MATTER NOT OTHERWISE PROVIDED FOR IN THIS SECTION [2006.01]**

**Note(s) [2006.01]**

This subclass covers subject matter that:

- a. is not provided for, but is most closely related to, the subject matter covered by the subclasses of this section, and
- b. is not explicitly covered by any subclass of another section.

**99/00 Subject matter not otherwise provided for in this section [2006.01]**