14 Steam engines, steam power plants; accumulators for live and exhaust steam, independent of the steam boiler

14 (IPC: F01) Machines or engines in general; Engine plants in general; Steam engines

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14a **Steam engines with reciprocating pistons**

14a **(IPC: F01B) Machines or engines, in general or of positive-displacement type**

14b **Steam power engines, and power engines for other driving agents if steam can be used instead, with rotary pistons**

14b **(IPC: F01C) Rotary-piston or oscillating-piston machines or engines**

14c **Steam turbines, air turbines**

14c **(IPC: F01D) Non-positive-displacement machines or engines**

14d **Slide valve controls for steam power engines with reciprocating pistons; flat valves and piston valves**

14d **(IPC: F01L) Cyclically operating valves for machines or engines**

14e **Rotary valve controls for steam power engines with reciprocating pistons, e.g. tubular valves, disks and cocks, and miscellaneous controls except 14d, 14f**

14f **Valve gear for steam power engines with reciprocating pistons**

14g **Accessories for steam power engine; balancing devices for pumps and blowers without flywheels; condensers, insofar as the operation of the steam power engine is modified**

14h **Special equipment for the utilisation of steam energy, accumulators independent of the boiler**

14h **(IPC: F01K) Steam engine plants; Steam accumulators; Engine plants not otherwise provided for; Engines using special working fluids or cycles**

14i **(IPC: F01M) Lubricating of machines or engines in general; Lubricating internal-combustion engines**

14k **(IPC: F01N) Gas-flow silencers or exhaust apparatus for machines or engines in general; Gas-flow silencers or exhaust apparatus for internal combustion engines**

14l **(IPC: F01P) Cooling of machines or engines in general; Cooling of internal combustion engines**

14a Steam engines with reciprocating pistons

14a-1 Steam engines for locomotives (driving gear 20b-10)

14a-2 Steam power plants assembled as a unit, and stationary or mobile locomobiles and small steam engines

14a-3 Single-acting engines (14a-13; 14a-14)

14a-4	Double-acting high-pressure engines
14a-5	Compound engines with double and multiple expansion
14a-6	Tandem engines
14a-7	Compound differential pistons
14a-8	Arrangement of several pistons in one cylinder and opposed pistons
14a-9	Engines without connecting rods and crankshafts, special arrangements
14a-10	Moving cylinders, also telescopic
14a-11	Oscillating cylinders
	Steam engines with cylinders parallel to the main shaft (59a; 46a10)
14a-12/01	with swash plate drive
14a-12/02	with cam disk-drive for several cylinders
14a-12/03	with drill-like drive of the piston
14a-12/04	with curved groove drive for one cylinder
14a-13	Radial engines with rotary cylinders or with alternating rotary and fixed cylinders
14a-14	Radial engines with fixed cylinders
14a-15	Balancing of masses (46a11; 47h-20; 47h-25; 47h-26; 65f2-6) and apparatus compensation of the expansion or the torque of individual parts (14c-22; 42c-42)
	Components of piston steam engines (general 47b; 47f)
14a-16/01	Frames
14a-16/02	Gears
14a-16/03	Pistons and piston rods
14a-16/04	Crossheads
14a-16/05	Pipes
14a-16/06	Connecting rods
14a-16/07	Stuffing boxes
14a-16/08	Crankshafts and crankshaft bearings
13a-16/09	Cylinders
14a-17	Parallel flow engines
14a-18	Power drive of machines and power transmission devices (14c-14; 65f1; 65f2)
14a-19	Exhaust steam, bleeder and counter-pressure steam engines (14c-17)
14a-20	Steam engines with after-connected exhaust steam engines (exhaust steam turbines 14c-17)

14a **(IPC: F01B) Machines or engines, in general or of positive-displacement type, e.g. steam engines** (of rotary-piston or oscillating-piston type 14b; of non-positive-displacement type 14c; crankshafts, crossheads, connecting-rods 47b; flywheels 47a3; gearings for interconverting rotary motion and reciprocating motion in general 47h; pistons, piston-rods, cylinders, for engines in general 47f2)

Note:
This subclass comprises the following subject-matter, except the matter provided for in subclasses 14b to 14l:
(a) engines for elastic fluids, e.g. steam engines,
(b) engines for liquids and elastic fluids,
(c) machines for elastic fluids,
(d) machines for liquids and elastic fluids.

14a-1/00	**Multi-cylinder reciprocating-piston machines or engines** (14a-3/00, 14a-5/00 take precedence)
14a-1/02	. with cylinders all in one line
14a-1/04	. with cylinders in V-arrangement
14a-1/06	. with cylinders in star or fan arrangement
14a-1/08	. with cylinders arranged oppositely relative to main shaft and of "flat" type

14a-1/10	. with more than one main shaft, e.g. coupled to common output shaft (combinations of two or more machines or engines 14a-21/00)
14a-1/12	. Separate cylinder-crankcase elements coupled together to form a unit
14a-3/00	**Reciprocating-piston machines or engines with cylinder axes coaxial with, or parallel or inclined to, main shaft axis**
14a-3/02	. with wobble-plate
14a-3/04	. the piston motion being transmitted by curved surfaces
14a-3/06	. . by multi-turn helical surfaces and automatic reversal
14a-3/08	. . . the helices being arranged on the pistons
14a-3/10	. Control of working-fluid admission or discharge peculiar thereto (suitable for more general application 14d)
14a-5/00	**Reciprocating-piston machines or engines with cylinder axes arranged substantially tangentially to a circle centred on main shaft axis**
14a-7/00	**Machines or engines with two or more pistons reciprocating within same cylinder or within essentially coaxial cylinders** (in opposite arrangement relative to main shaft 14a-1/08)
14a-7/02	. with oppositely reciprocating pistons
14a-7/04	. . acting on same main shaft
14a-7/06	. . . using only connecting-rods for conversion of reciprocatory into rotary motion or vice versa
14a-7/08	. . . . with side rods
14a-7/10	. . . . having piston-rod of one piston passed through other piston
14a-7/12	. . . using rockers and connecting-rods
14a-7/14	. . acting on different main shafts
14a-7/16	. with pistons synchronously moving in tandem arrangement
14a-7/18	. with differential piston (14a-7/20 takes precedence)
14a-7/20	. with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other
14a-9/00	**Reciprocating-piston machines or engines characterised by connections between pistons and main shafts and not specific to preceding groups** (connections disengageable during idling 14a-31/24)
14a-9/02	. with crankshaft
14a-9/04	. with rotary main shaft other than crankshaft
14a-9/06	. . the piston motion being transmitted by curved surfaces
14a-9/08	. . with ratchet and pawl
14a-11/00	**Reciprocating-piston machines or engines without rotary main shaft, e.g. of free-piston type**
14a-11/02	. Equalising or cushioning devices
14a-11/04	. Engines combined with reciprocatory driven devices, e.g. hammers (with pumps 14a-23/08; predominating aspects of driven devices, see the relevant classes for the devices)
14a-11/06	. . for generating vibration only
14a-11/08	. with direct fluid transmission link (14a-11/02 takes precedence)
14a-13/00	**Rotary machines or engines in which the working fluid is exclusively displaced by or, exclusively, displaced one or more reciprocating pistons**
14a-13/02	. with one cylinder only
14a-13/04	. with more than one cylinder
14a-13/06	. . in star arrangement
14a-15/00	**Reciprocating-piston machines or engines with movable cylinders other than provided for in 14a-13/00** (with movable cylinder sleeves for working-fluid control 14d)
14a-15/02	. with reciprocating cylinders (with one piston within another 14a-7/20)
14a-15/04	. with oscillating cylinder
14a-15/06	. . Control of working-fluid admission or discharge peculiar thereto

14a-17/00	**Reciprocating-piston machines or engines characterised by use of uniflow principle**
14a-17/02	. Engines
14a-17/04	. . Steam engines
14a-19/00	**Positive-displacement machines or engines of flexible-wall type**
14a-19/02	. with plate-like flexible members
14a-19/04	. with tubular flexible members
14a-21/00	**Combinations of two or more machines or engines** (14a-23/00 takes precedence; regulating or controlling, see the relevant groups; combinations of two or more pumps 59a, 27b; fluid gearing 47h)
14a-21/02	. the machines or engines being all of reciprocating-piston type
14a-21/04	. the machines or engines being not all of reciprocating-piston type, e.g. of reciprocating steam engine with steam turbine
14a-23/00	**Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby** (14a-11/00 takes precedence, aspects predominantly concerning driven devices see the relevant classes for these devices; regulating or controlling, see the relevant groups; fluid gearing 47h)
14a-23/02	. Adaptations for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant classes for vehicles)
14a-23/04	. . the vehicles being waterborne vessels
14a-23/06	. Adaptations for driving, or combinations with, hand-held tools or the like
14a-23/08	. Adaptations for driving, or combinations with, pumps
14a-23/10	. Adaptations for driving, or combinations with, electric generators
14a-23/12	. Adaptations for driving rolling mills or other heavy reversing machinery
14a-25/00	**Regulating, controlling, or safety means** (regulating or controlling in general 42r)
14a-25/02	. Regulating or controlling by varying working-fluid admission or exhaust, e.g. by varying pressure or quantity (distributing or expansion valve gear 14d)
14a-25/04	. . Sensing elements
14a-25/06	. . . responsive to speed
14a-25/08	. . Final actuators
14a-25/10	. . . Arrangements or adaptations of working-fluid admission for discharge valves (valves per se 47g1)
14a-25/12	. . Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone 14a-25/04; final actuators alone 14a-25/08)
14a-25/14	. . peculiar to particular kinds of machines or engines
14a-25/16	. Safety means responsive to specific conditions (against water hammer or the like in steam engines 14a-31/34)
14a-25/18	. . preventing rotation in wrong direction
14a-25/20	. Checking operation of safety devices
14a-25/22	. Braking by redirecting working fluid
14a-25/24	. . thereby regenerating energy
14a-25/26	. Warning devices
14a-27/00	**Starting of machines or engines** (starting combustion engines 46l)
14a-27/02	. of reciprocating-piston engines
14a-27/04	. . by directing working-fluid supply, e.g. by aid of by-pass steam conduits
14a-27/06	. . . specially for compound engines
14a-27/08	. . Means for moving crank off dead-centre (turning-gear in general 47h)
14a-29/00	**Machines or engines with pertinent characteristics other than those provided for in preceding main groups**
14a-29/02	. Atmospheric engines, i.e. atmosphere acting against vacuum
14a-29/04	. characterised by means for converting from one type to a different one
14a-29/06	. . from steam engine into combustion engine
14a-29/08	. Reciprocating-piston machines or engines not otherwise provided for
14a-29/10	. . Engines (refrigerating expansion engines 17a)

14a-29/12	. . . Steam engines (toy steam engines 77f-25/00)
14a-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, 47a2)
14a-31/02	. De-icing means for engines having icing phenomena
14a-31/04	. Means for equalising torque in reciprocating-piston machines or engines (compensation of inertial forces, suppression of vibration in systems 47a3)
14a-31/06	. Means for compensating relative expansion of component parts
14a-31/08	. Cooling of steam engines (cooling of fluid machines or engines in general 14l); Heating; Heat insulation (heat insulation in general 47f1-59/00)
14a-31/10	. Lubricating arrangements of steam engines (of fluid machines or engines in general 14i)
14a-31/12	. Arrangements of measuring or indicating devices (warning apparatus 14a-25/26; measuring instruments or the like per se 42)
14a-31/14	. Changing of compression ratio
14a-31/16	. Silencers specially adapted for steam engines (arrangements of exhaust pipes or tubes on steam engines 14a-31/30; gas-flow silencers or exhaust silencers for machines or engines in general 14k)
14a-31/18	. Draining
14a-31/20	. . of cylinders
14a-31/22	. Idling devices, e.g. having by-passing valves
14a-31/24	. . Disengagement of connections between pistons and main shafts
14a-31/26	. Other component parts, details, or accessories, peculiar to steam engines
14a-31/28	. . Cylinders or cylinder covers
14a-31/30	. . Arrangements of steam conduits
14a-31/32	. . Arrangements or adaptations of vacuum breakers
14a-31/34	. . Safety means against water hammer or against the penetration of water (steam traps per se 47g2)
14a-31/36	. . . automatically cutting-off steam supply

14b	**Steam power engines, and power engines for other driving agents if steam can be used instead, with rotary pistons** (27c-1 – 27c-6; 42e-7; 46a5; 46d-5/01; 46d-5/05; 47f-22; 47f-26; 47h-18; 69e; 63c-34; 88b-2)
14b-1/01	Engines with sliding abutments, general, driven by mechanical force engagement
14b-1/02	Engines with sliding abutments, general, positively driven
14b-1/03	Engines in which sliding abutments are parallel to the axis
14b-2/01	Engines in which the rotary abutments, e.g. flap-shaped, oscillate in the plane of the piston path
14b-2/02	Engines in which the rotary abutments, e.g. flap-shaped, oscillate across the plane of the piston path
14b-2/03	Engines in which the rotary abutments rotate in the same direction, also intermittently, in the plane of the piston path
14b-2/04	Engines in which the rotary abutments rotate in the same direction, across the plane of the piston path
14b-3/01	Engines with vane pistons, general, driven by mechanical force engagement
14b-3/02	Engines with vane pistons, general, positively driven
14b-3/03	Engines with vane pistons parallel to the axis
14b-4/01	Engines with rotary members such as rotary pistons mounted on the rotor or drum for oscillation or parallel, including intermittent movement, general with rotary members such as rotary
14b-4/02	Engines with rotary members such as rotary pistons mounted on the rotor or drum for oscillation or parallel, including intermittent movement parallel to the axis
14b-5	Engines with alternating driven and fixed pistons
14b-6	Engines with pistons of different angular velocity
14b-7/01	Gear-type engines and engines with intermeshing piston drums, general

14b-7/02	Gear-type engines and engines with intermeshing piston drums with herringbone gear teeth
14b-7/03	Gear-type engines and engines with intermeshing piston drums, interior engagement
14b-8	Engines with oscillating pistons
14b-9	Engines with eccentric motion of the piston or abutment
14b-10/01	Engines with worm pistons, two of which intermesh
14b-10/02	Engines with worm pistons, also Hindley's worm and ratchet gear abutments
14b-11/01	Engines with ball-shaped housings, also caps, zones
14b-11/02	Engines with two, three or multi-cornered housings
14b-11/03	Engines with the rotary housing and pistons movable therein or within the piston drum
14b-11/04	Hose and band [collapsible wall] engines
14b-11/10	Engines of special structure
14b-12/01	Packings
14b-12/02	Controls
14b-12/03	Lubrication, heating, cooling
14b-12/04	Miscellaneous

14b (IPC: F01C) Rotary-piston or oscillating-piston machines or engines

Notes

1. The subject-matter of this subclass comprises:
(a) rotary-piston or oscillating-piston engines for elastic fluids, e.g. steam,
(b) rotary-piston or oscillating-piston engines for liquids and elastic fluids,
(c) rotary-piston or oscillating-piston machines for liquids and elastic fluids.
2. In this subclass, the term "rotary-piston machine" embraces the German terms "Drehkolbenmaschinen", "Kreiskolbenmaschinen", and "Umlaufkolbenmaschinen".

14b-1/00	**Rotary-piston machines or engines (with axes of co-operating members non-parallel 14b-3/00; with the working-chamber walls at least partly resiliently deformable 14b-5/00; with fluid ring or the like 14b-7/00; rotary-piston machines or engines in which the working fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons 14a-13/00)**
14b-1/02	. of arcuate-engagement type, i.e. with circular translatory movement of co-operating members
14b-1/04	. . of internal-axis type
14b-1/06	. . of other than internal-axis type (coaxial type 14b-1/42)
14b-1/08	. of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
14b-1/10	. . of internal-axis type with the outer member having more teeth or tooth-equivalents, than the inner member
14b-1/12	. . of other than internal-axis type
14b-1/14	. . . with toothed rotary pistons
14b-1/16	. . . . with helical teeth, e.g. chevron-shaped, screw type
14b-1/18	. . . . with similar tooth forms (14b-1/16 takes precedence)
14b-1/20	. . . . with dissimilar tooth forms (14b-1/16 takes precedence)
14b-1/22	. of internal-axis type with equidirectional movement of co-operating members at the points of interengagement the inner member having more teeth or tooth-equivalents than the outer member
14b-1/24	. of counter-engagement type, i.e. the movement of co-operating members at the points of interengagement being in opposite directions
14b-1/26	. . of internal-axis type

14b-1/28	. . of other than internal-axis type
14b-1/30	. Rotary-piston machines or engines not restricted to only one of the subgroups 14b-1/02, 14b-1/08, 14b-1/22 or 14b-1/24
14b-1/32	. . having both the movements defined in subgroup 14b-1/02 and relative reciprocation between members
14b-1/34	. . having the movements defined in subgroup 14b-1/08 or 14b-1/22 and relative reciprocation between members
14b-1/36	. . having both the movements defined in subgroups 14b-1/22 and 14b-1/24
14b-1/38	. . having the movement defined in 14b-1/02 and having a hinged member
14b-1/40	. . having the movement defined in 14b-1/08 and having a hinged member
14b-1/42	. . with coaxially-mounted members have continuously-changing circumferential distance
14b-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 14b-5/00)**
14b-3/02	. the axes being arranged at an angle of 90°
14b-3/04	. . with axially-sliding vanes
14b-3/06	. the axes being arranged otherwise than at an angle of 90°
14b-3/08	. . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing
14b-5/00	**Rotary-piston machines or engines with the working-chamber walls at least partly resiliently deformable**
14b-5/02	. the resiliently-deformable wall being part of the inner member, e.g. of a rotary piston
14b-5/04	. the resiliently-deformable wall being part of the outer member, e.g. of a housing
14b-5/06	. the resiliently-deformable wall being a separate member
14b-5/08	. . of tubular form, e.g. hose
14b-7/00	**Rotary-piston machines or engines with fluid ring or the like**
14b-9/00	**Oscillating-piston machines or engines**
14b-11/00	**Combinations of two or more machines or engines, each being of rotary-piston or oscillating-piston type (14b-13/00 takes precedence; fluid gearing 47h)**
14b-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)**
14b-13/02	. for driving hand-held tools or the like
14b-13/04	. for driving pumps or compressors
14b-17/00	**Arrangements for drive of co-operating members, e.g. for rotary piston and casing**
14b-17/02	. of toothed-gearing type
14b-17/04	. of cam-and-follower type
14b-17/06	. using cranks, universal joints, or similar elements
14b-19/00	**Sealing arrangements in rotary-piston machines or engines (sealings in general 47f2)**
14b-19/02	. Radially-movable sealings for working fluids
14b-19/04	. . of rigid material
14b-19/06	. . of resilient material
14b-19/08	. Axially-movable sealings for working fluids
14b-19/10	. Sealings for working fluids between radially and axially movable parts
14b-19/12	. for other than working fluid
14b-21/00	**Component parts, details, or accessories, not provided for in, or of interest apart from, other groups**
14b-21/02	. Arrangements of bearings (bearing constructions 47b)
14b-21/04	. Lubrication (of machines or engines in general 14i)

14b-21/06	. Heating; Cooling (of machines or engines in general 14l); Heat insulation (heat insulation in general 47f1)
14b-21/08	. Rotary pistons (reciprocating pistons in general 47f2)
14b-21/10	. Outer members for co-operation with rotary pistons; Casings (casings for rotary engines or machines in general 47a2)
14b-21/12	. Control of working-fluid admission or discharge (suitable for more general application 14d)
14b-21/14	. . for variable fluid distribution
14b-21/16	. Other regulation or control

14c Steam turbines, air turbines (gas turbines 46f; water turbines 88a)

14c-1	Impact wheels
14c-2	Reaction wheels
14c-3	Friction and helical turbines
14c-4/01	Impulse or velocity turbines with axial admission
14c-4/02	Impulse or velocity turbines with radial admission
14c-4/03	Impulse or velocity turbines with repeated admission to the same rotor
14c-5	Combined impulse and reaction turbines
14c-6/01	Reaction turbines with axial admission
14c-6/02	Reaction turbines with radial admission
14c-7/01	Counter-rotating turbines with axial admission
14c-7/02	Counter-rotating turbines with radial admission
14c-8/01	Nozzle regulation
14c-8/02	Valve regulation (14f; 47g)
14c-8/03	Mechanical regulation devices (14f; 47g)
14c-8/04	Hydraulic regulation devices (14f-8)
14c-8/05	Electric regulation devices
14c-8/06	Safety devices, checking of steam conditions and temperature in the turbine
14c-8/07	Reversion
14c-9	Turbines for several types of steam and steam mixtures (13g-4/01), cold steam turbines
14c-10/01	Superheating, intermediate superheating
14c-10/02	Heating, drying
14c-10/03	Removal of water
14c-10/04	Cooling
	Rotor blades (manufacture 7c; 49l-7)
14c-11/01	Blade shape
14c-11/02	Blade fastening
14c-11/03	Tip rings, stiffening wires
14c-11/04	Blade locking devices
14c-11/05	Construction materials, protection against erosion and corrosion
14c-11/06	Rotating blades, flexible blades
	Guiding apparatus
14c-12/01	Nozzles, manufacture and fastening
14c-12/02	Vanes, vane rings
14c-13/01	Waste steam and exhaust devices, condensation
14c-13/02	Utilisation of the waste steam of steam turbines, feed water pre-heating and production of supplementary water from turbine steam, as to structure and operation of the steam turbine (13b; 14h)
14c-14	Drive of work-producing machines by means of turbines (47b-20; 65f1-2), turbine power plants and regulation thereof
14c-15	Ship turbines (65f1)
14c-16	Locomotive turbines (20b)

14c-17/01	Waste steam turbines, utilisation of waste steam in turbines, regulation thereof (14a-20)
14c-17/02	Extracting and counter-pressure turbines (14a-19) regulation thereof
14c-17/03	Double and multiple pressure turbines, regulation thereof
14c-17/04	Turbines for accumulator and supplementary steam, regulation thereof (14h-3)
14c-17/05	Auxiliary turbines, regulation thereof
14c-18	Unloading
14c-19/01	Bearings (47b-4 – 47b-12; 88a)
14c-19/02	Lubrication (47e)
14c-19/03	Support of housings (47a-16)
14c-20/01	Stuffing boxes (47f-23; 47f-24), liquid stuffing boxes
14c-20/02	Labyrinth packings (47f-26), utilisation of sealing steam
14c-21	Glands
14c-22/01	Housings
14c-22/02	Rotors, drum or wheels, elimination of the danger of oscillation phenomena (measurement thereof 42c-42)
14c-22/03	Foundations (37f; 47a-16), assembly with boiler, rust protection
	Air turbines
14c-23/01	Compressed-air turbines (46d-5/03)
14c-23/02	Suction-air turbines (46d-5/08)
14c-23/03	Prevention of ice formation in air turbines

14c (IPC: F01D) Non-positive displacement machines or engines, e.g. steam turbines

Note
The subject-matter of this subclass comprises:
(a) non-positive-displacement engines for elastic fluids, e.g. steam turbines,
(b) non-positive-displacement engines for liquids and elastic fluids,
(c) non-positive-displacement machines for elastic fluids,
(d) non-positive-displacement machines for liquids and elastic fluids.

14c-1/00	**Non-positive-displacement machines or engines, e.g. steam turbines** (with working-fluid in opposite axial directions for balancing axial thrust 14c-3/02; with other than pure rotation 14c-23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor 14h)
14c-1/02	. with stationary working-fluid guiding means and bladed or like rotor, e.g. multi-bladed impulse steam turbines (of reaction type 14c-1/18)
14c-1/04	. . traversed by the fluid substantially axially
14c-1/06	. . traversed by the fluid substantially radially
14c-1/08	. . . having inward flow
14c-1/10	. . having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (14c-1/12 takes precedence)
14c-1/12	. . with repeated action on same blade ring
14c-1/14	. . . traversed by the fluid substantially radially
14c-1/16	. . characterised by having both reaction stages and impulse stages
14c-1/18	. of reaction type (with pressure-velocity transformation exclusively in rotor 14c-1/32)
14c-1/20	. . traversed by the fluid substantially axially
14c-1/22	. . traversed by the fluid substantially radially
14c-1/24	. characterised by contra-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like
14c-1/26	. . traversed by the fluid substantially axially
14c-1/28	. . traversed by the fluid substantially radially

14c-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 14c-13/00)
14c-1/32	. with pressure-velocity transformation exclusively in rotor
14c-1/34	. characterised by non-bladed rotor, e.g. with drilled holes (sirens 74d)
14c-1/36	. . using fluid friction
14c-3/00	**Machines or engines with axial-thrust balancing effected by working fluid**
14c-3/02	. characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction
14c-3/04	. axial thrust being compensated by thrust-balancing dummy piston or the like
14c-5/00	**Blades; Blade-carrying members** (nozzle boxes 14c-9/02)**; Heating, heat-insulating, cooling, or anti-vibration means on the blades or the members**
14c-5/02	. Blade-carrying members, e.g. rotors (rotors of non-bladed type 14c-1/34; stators 14c-9/00)
14c-5/04	. . for radial-flow machines or engines
14c-5/06	. . Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections
14c-5/08	. . Heating, heat-insulating, or cooling means
14c-5/10	. . Antivibration means
14c-5/12	. Blades (blade roots 14c-5/30; rotors with blades adjustable in operation 14c-7/00; stator blades 14c-9/02)
14c-5/14	. . Form or construction (selecting particular materials, measures against erosion or corrosion 14c-5/28)
14c-5/16	. . . for counteracting blade vibration
14c-5/18	. . . Hollow blades; Heating, heat-insulating, or cooling means on blades
14c-5/20	. . . Specially-shaped blade tips to seal space between tips and stator
14c-5/22	. . Blade-to-blade connections, e.g. by shrouding
14c-5/24	. . . using wire or the like
14c-5/26	. . Anti-vibration means not restricted to blade form or construction or to blade-to-blade connections
14c-5/28	. . Selecting particular materials; Measures against erosion or corrosion
14c-5/30	. Fixing blades to rotors; Blade roots
14c-5/32	. . Locking, e.g. by final locking-blades or keys
14c-5/34	. Rotor-blade aggregates of unitary construction
14c-7/00	**Rotors with blades adjustable in operation; Control thereof** (for reversing 14c-1/30)
14c-7/02	. having adjustment responsive to speed
14c-9/00	**Stators** (non-fluid guiding aspects of casings, regulating, controlling, or safety aspects, see the relevant groups)
14c-9/02	. Nozzles; Nozzle boxes; Stator blades; Guide conduits
14c-9/04	. . forming ring or sector
14c-9/06	. Fluid supply conduits to nozzles or the like
14c-11/00	**Preventing or minimising internal leakage of working fluid, e.g. between stages** (sealings in general 47f2)
14c-11/02	. by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator 14c-11/08)
14c-11/04	. . using sealing fluid, e.g. steam
14c-11/06	. . . Control thereof
14c-11/08	. for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor 14c-5/20)
14c-11/10	. . using sealing fluid, e.g. steam
14c-13/00	**Combinations of two or more machines or engines** (14c-15/00 takes precedence; regulating or controlling, see the relevant groups; combinations of two or more pumps 27c; fluid gearing 47h)
14c-13/02	. Working-fluid interconnection of machines or engines

14c-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)

14c-15/02 . Adaptations for driving vehicles, e.g. locomotives (arrangement in vehicles, see the relevant vehicle classes)
14c-15/04 . . the vehicles being waterborne vessels
14c-15/06 . Adaptations for driving, or combinations with, hand-held tools or the like
14c-15/08 . Adaptations for driving, or combinations with, pumps
14c-15/10 . Adaptations for driving, or combinations with, electric generators
14c-15/12 . Combinations with mechanical gearing (driven by multiple engines 14c-13/00)

14c-17/00 **Regulating or controlling by varying flow** (for reversing 14c-1/30; by varying rotor blade position 14c-7/00; specially for starting 14c-19/00; shutting-down 14c-21/00; regulating or controlling in general 42r)

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

14c-19/00 **Starting of machines or engines; Regulating, controlling, or safety means in connection therewith** (warming-up before starting 14c-25/10; turning or inching gear 14c-25/34)

14c-19/02 . dependent on temperature of component parts, e.g. of turbine casing

14c-21/00 **Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for**

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

14c-23/00 **Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type**

14c-25/00 **Component parts, details, or accessories, not provided for in, or of interest apart from, other groups**

14c-25/02 . De-icing means for engines having icing phenomena
14c-25/04 . Antivibration arrangements
14c-25/06 . . for preventing blade vibration (means on blade-carrying members or blades 14c-5/00)
14c-25/08 . Cooling (of machines or engines in general 14l); Heating; Heat insulation (of blade-carrying members, of blades 14c-5/00)

14c-25/10	. . Heating, e.g. warming-up before starting
14c-25/12	. . Cooling
14c-25/14	. . Casings modified therefor (double casings 14c-25/26)
14c-25/16	. Bearings arrangement or adaptations (bearings per se 47b)
14c-25/18	. Lubricating arrangements (of machines or engines in general 14i)
14c-25/20	. . using lubrication pumps
14c-25/22	. . using working fluid or other gaseous fluid as lubricant
14c-25/24	. Casings (modified for heating or cooling 14c-25/14); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general 47a2)
14c-25/26	. . Double casings; Measures against temperature strain in casings
14c-25/28	. Supporting or mounting arrangements, e.g. for turbine casing
14c-25/30	. Exhaust heads, chambers, or the like
14c-25/32	. Collecting of condensation water; Drainage
14c-25/34	. Turning or inching gear
14c-25/36	. . using electric motors

14d Slide valve controls for steam power engines with reciprocating pistons; flat valves and piston valves (slide valve structures 47g)

Slide valves

14d-1	D valves (46b1-16; 47g-26; 47g-29)
14d-2	Drag valves
14d-3	Main valves with expansion valve
14d-4	Meyer valves
14d-5	Rider valves
14d-6	Slide valves incorporating other valves or control elements
14d-7	Piston valves (46b1-18; 47g-28)
14d-8	Annular slide valves
14d-9	Slide valves with longitudinal and transverse movement
14d-10	Separated slide valves, and special types of slide valves
14d-11	Unloading of slide valves (47g-34) and control element details

Control and reversing of slide valves, inclusive of controls for engines without flywheels (46d; 87b-2)

14d-12	Drives for controls with and without expansion and arrangements for the central drive of control elements (46b1)
14d-13	Control by means of the piston or piston rod
14d-14	Movement of the valve by steam alone, with or without special control pistons
14d-15	Control by means of auxiliary steam control gear
14d-16	Control by means of auxiliary piston rod control gear
14d-17	Valve moved by piston impact
14d-18	Valve moved through piston rod motion
14d-19	Valve moved through piston rod motion, with expansion
14d-20	Reversing by interchanging the admission and exhaust (46b1-21)
14d-21	Reversing and changing the admission by displacing the eccentric
14d-22	Reversing and changing the admission by means of links or guide rods
14d-23	Reversing devices, e.g. drives, rods (46b1-21)
14d-24	Cataract controls
14d-25	Control by fluid pressure
14d-26	Components of valve controls

14d (IPC: F01L) Cyclically operating valves for machines or engines (valves in general 47g1)

Valve-gear for internal-combustion piston engines or for other machines or engines with positive working-fluid displacement (valve-gear specially for steam engines or

specially for other machines or engines with variable fluid distribution 14d-15/00 to 14d-35/00)

14d-1/00	**Valve-gear or valve arrangements, e.g. lift-valve gear** (lift valve and valve seat assemblies per se 14d-3/00; slide-valve gear 14d-5/00; actuated non-mechanically 14d-9/00; valve arrangements in working piston or piston-rod 14d-11/00; modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations 14d-13/00)
14d-1/02	. Valve drive (transmitting-gear between valve drive and valve 14d-1/12)
14d-1/04	. . by means of cams, camshafts, cam discs, eccentrics, or the like (14d-1/10 takes precedence)
14d-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
14d-1/08	. . . Shape of cams
14d-1/10	. . by means of crank-driven or eccentric-driven rods
14d-1/12	. Transmitting-gear between valve drive and valve (simultaneously operating two or more valves 14d-1/26)
14d-1/14	. . Tappets; Push-rods
14d-1/16	. . . Silencing impact; Reducing wear
14d-1/18	. . Rocking arms or levers
14d-1/20	. Adjusting or compensating clearance
14d-1/22	. . automatically, e.g. mechanically
14d-1/24	. . . by fluid means, e.g. hydraulically
14d-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 14d-1/28)
14d-1/28	. characterised by the provision of coaxial valves; characterised by the provision of valves co-operating with both intake and exhaust ports
14d-1/30	. characterised by the provision of positively opened and closed valves, i.e. desmodromic valves
14d-1/32	. characterised by the provision of means for rotating lift valves, e.g. to diminish wear
14d-1/34	. characterised by the provision of means for changing the timing of the valves without changing the duration of opening
14d-1/36	. peculiar to machines or engines of specific type other than four-stroke cycle
14d-1/38	. . for engines with other than four-stroke cycle, e.g. with two-stroke cycle (14d-1/26, 14d-1/28 take precedence)
14d-1/40	. . for engines with scavenging charge near top dead-centre position, e.g. by overlapping inlet and exhaust time (scavenging aspects 46a)
14d-1/42	. . for machines or engines characterised by cylinder arrangement, e.g. star or fan
14d-1/44	. Multiple-valve gear or arrangements, not provided for in preceding subgroups, e.g. with lift and different valves
14d-1/46	. Component parts, details, or accessories, not provided for in preceding subgroups
14d-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**
14d-3/02	. Selecting particular materials for valve members or valve seats; Valve members or valve seats composed of two or more materials
14d-3/04	. . Coated valve members or valve seats
14d-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 14d-1/32)
14d-3/08	. Valve guides; Sealing of valve stem, e.g. sealing by lubricant
14d-3/10	. Connecting springs to valve members
14d-3/12	. Cooling of valves
14d-3/14	. . by means of a liquid or solid coolant, e.g. sodium, in a closed chamber in a valve
14d-3/16	. . by means of a fluid flowing through or along valve, e.g. air (for sealing only 14d-3/08)
14d-3/18	. . . Liquid cooling of valve

14d-3/20	. Shapes or constructions of valve members, not provided for in preceding subgroups of this group
14d-3/22	. Valve seats not provided for in preceding subgroups of this group; Fixing of valve seats
14d-3/24	. Safety means or accessories, not provided for in preceding subgroups of this group
14d-5/00	**Slide-valve gear or valve arrangements** (with pure rotary or oscillatory movement 14d-7/00)
14d-5/02	. with other than cylindrical, sleeve, or part-annularly-shaped valves, e.g. with flat-type valves
14d-5/04	. with cylindrical, sleeve, or part-annularly-shaped valves
14d-5/06	. . surrounding working cylinder or piston
14d-5/08	. . . Arrangements with several movements or several valves, e.g. one valve inside the other (with part-annularly-shaped valves 14d-5/12)
14d-5/10	. . . . with reciprocating and other movement of same valve
14d-5/12	. . . Arrangements with part-annularly-shaped valves
14d-5/14	. characterised by the provision of valves with reciprocating and other movements (surrounding working cylinder or piston 14d-5/06)
14d-5/16	. . with reciprocating and other movement of same valve, e.g. longitudinally and in cross direction of working cylinder
14d-5/18	. . with reciprocatory valve and other slide valve
14d-5/20	. specially for two-stroke engines (14d-5/06 and 14d-5/14 take precedence)
14d-5/22	. Multiple-valve arrangements (with valves surrounding working cylinder or piston 14d-5/06; with reciprocatory and other slide valves 14d-5/18; specially for two-stroke engines 14d-5/20)
14d-5/24	. Component parts, details, or accessories, not provided for in preceding subgroups of this group
14d-7/00	**Rotary or oscillatory slide-valve gear or valve arrangements** (slide valves with combined rotary and non-rotary movements, combinations of rotary and non-rotary slide valves 14d-5/00)
14d-7/02	. with cylindrical, sleeve, or part-annularly-shaped valves (of disc type 14d-7/06; of conical type 14d-7/08)
14d-7/04	. . surrounding working cylinder or piston
14d-7/06	. with disc-type valves
14d-7/08	. with conically- or frusto-conically-shaped valves
14d-7/10	. with valves of other specific shape, e.g. spherical
14d-7/12	. specially for two-stroke engines (14d-7/04 takes precedence)
14d-7/14	. Multiple-valve arrangements (with valves surrounding working cylinder or piston 14d-7/04; specially for two-stroke engines 14d-7/12)
14d-7/16	. Sealing or packing arrangements specially therefor
14d-7/18	. Component parts, details, or accessories, not provided for in preceding subgroups of this group
14d-9/00	**Valve-gear or valve arrangements actuated non-mechanically**
14d-9/02	. by fluid means, e.g. hydraulic
14d-9/04	. by electric means
14d-11/00	**Valve arrangements in working piston or piston-rod**
14d-11/02	. in piston
14d-11/04	. . operated by movement of connecting-rod
14d-11/06	. . . operating oscillatory valve
14d-13/00	**Modifications of valve-gear to facilitate reversing, braking, starting, changing compression ratio, or other specific operations**
14d-13/02	. for reversing
14d-13/04	. for starting by means of fluid pressure
14d-13/06	. for braking
14d-13/08	. for decompression, e.g. during starting; for changing compression ratio

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

Note:
The groups under this guide heading do not fully embrace subject-matter restricted to rotary, oscillatory, or valve-lift gear or valve arrangements, classified in groups 14d-33/00 and 14d-35/00. However, the present groups do embrace the following subject-matter thereof: valve drives or means external to valves for adjustment during operation, tripping-gear, reversing-gear, use of pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines.

14d-15/00	**Valve-gear or valve arrangements, e.g. with reciprocatory slide valves, other than provided for in groups 14d-17/00 to 14d-29/00** (valve drive or external valve-adjustment during operation, see the relevant groups, e.g. 14d-31/00; tripping-gear or tripping of valves 14d-31/00)
14d-15/02	. with valves other than cylindrical, sleeve, or part-annularly-shaped, e.g. flat D-valves
14d-15/04	. . main valve being combined with auxiliary valve (of drag-valve type 14d-15/10)
14d-15/06	. . . of Meyer or Rider type, i.e. in which the expansion is varied at the expansion valve itself
14d-15/08	. with cylindrical, sleeve, or part-annularly-shaped valves; Such main valves combined with auxiliary valves
14d-15/10	. with main slide valve and auxiliary valve dragged thereby
14d-15/12	. characterised by having means for effecting pressure equilibrium between two different cylinder spaces at idling
14d-15/14	. Arrangements with several co-operating main valves, e.g. reciprocatory and rotary
14d-15/16	. . with reciprocatory slide valves only
14d-15/18	. Valve arrangements not provided for in preceding subgroups of this main group
14d-15/20	. Component parts, details, or accessories, not provided for in preceding subgroups of this main group
14d-17/00	**Slide-valve gear or valve arrangements with cylindrical, sleeve, or part-annularly-shaped valves surrounding working cylinder or piston**
14d-17/02	. Drive, or adjustment during operation, peculiar thereto, e.g. for reciprocating and oscillating movements or for several valves one inside the other
14d-19/00	**Slide-valve gear or valve arrangements with reciprocatory and other movement of same valve, other than provided for in group 14d-17/00, e.g. longitudinally of working cylinder and in cross direction**
14d-19/02	. Drive, or adjustment during operation, peculiar thereto
14d-21/00	**Use of working pistons or piston-rods as fluid-distributing valves or as valve-supporting elements, e.g. in free-piston machines**
14d-21/02	. Piston or piston-rod used as valve member
14d-21/04	. Valves arranged in or on piston or piston-rod
14d-23/00	**Valves controlled by impact of piston, e.g. in free-piston machines**
14d-25/00	**Drive, or adjustment during operation, of distribution or expansion valves by non-mechanical means**
14d-25/02	. by fluid means
14d-25/04	. . by working fluid of machine or engine, e.g. free-piston machine
14d-25/06	. . . Arrangements with main and auxiliary valves, at least one of them being fluid-driven
14d-25/08	. by electric or magnetic means
14d-27/00	**Distribution or expansion-valve gear peculiar to free-piston machines or engines and not provided for in groups 14d-21/00 to 14d-25/00**
14d-27/02	. the machine or engine having rotary or oscillatory valves

14d-27/04 . Delayed-action controls, e.g. of cataract- or dash-pot-type

14d-29/00 Reversing-gear (equally usable for control of degree of working fluid admission, and reversing being of secondary importance 14d-31/00)
14d-29/02 . by displacing eccentric
14d-29/04 . by links or guide rods
14d-29/06 . by interchanging inlet and exhaust ports
14d-29/08 . specially for rotary or oscillatory valves
14d-29/10 . Details, e.g. drive
14d-29/12 . . Powered reverse gear

14d-31/00 Valve drive, valve adjustment during operation, or other valve control, not provided for in groups 14d-15/00 to 14d-29/00 (sensing elements measuring the variable or condition to be controlled or regulated 14a)
14d-31/02 . with tripping-gear (for oscillatory valves 14d-31/06); Tripping of valves
14d-31/04 . . with positively-driven trip levers
14d-31/06 . with tripping-gear specially for oscillatory valves; Oscillatory tripping-valves, e.g. of Corliss type
14d-31/08 . Valve drive or valve adjustment, apart from tripping aspects; Positively-driven gear
14d-31/10 . . the drive being effected by eccentrics (14d-31/14 takes precedence)
14d-31/12 . . . Valve adjustment by displacing eccentric
14d-31/14 . . Valve adjustment by links or guide rods, e.g. in valve-gears with eccentric drive
14d-31/16 . . the drive being effected by specific means other than eccentric, e.g. cams; Valve adjustment in connection with such drives
14d-31/18 . . specially for rotary or oscillatory valves
14d-31/20 . . . Valve adjustment
14d-31/22 . . specially for lift valves
14d-31/24 . . . Valve adjustment

Rotary or oscillatory slide-valve gear or lift-valve gear or such valve arrangements specially for steam engines or specially for other machines or engines with variable working-fluid distribution (drive, adjustment during operation, tripping-gear, reversing-gear, use of working pistons or piston-rods as valves or as valve-supporting elements, valve-gear or valve arrangements peculiar to free-piston machines or engines 14d-15/00 to 14d-31/00)

14d-33/00 Rotary or oscillatory slide-valve gear or valve arrangements
14d-33/02 . rotary
14d-33/04 . oscillatory

14d-35/00 Lift-valve gear or valve arrangements
14d-35/02 . Valves
14d-35/04 . Arrangements of valves in the machine or engine, e.g. relative to working cylinder

14e Rotary valve controls for steam power engines with reciprocating pistons, e.g. tubular valves, disks and cocks, and miscellaneous controls except 14d, 14f (cock structures 47g)

14e-1 Tripping Corliss controls, Corliss valves
14e-2 Positive Corliss controls, Corliss valves
14e-3 Control by means of oscillating cylindrical, or tubular valves
14e-4 Control by means of rotary cylindrical or tubular valves
14e-5 Controls with oscillating disks
14e-6 Controls with rotating disks
14e-7 Electrically driven controls, also valve gears
14e-8 Regulating apparatus for controls

14f Valve gear for steam power engines with reciprocating pistons (valve structures 47g; valve gears for internal combustion engines 46b1; electrically driven valve gears 14e-7)

14f-1 Tripping valve gears in general

14f-2 Tripping valve gears with positively driven trip levers
14f-3 Valve gears with shaft governors
14f-4 Positively driven valve gears with variable direction of transmission, and also with direct drive
14f-5 Positively driven valve gears with double eccentric drives, link-motion controls
14f-6 Positively driven valve gears with variable drive from a single eccentric point

Cam-operated valve gear

14f-7/01 Drive by means of rolling cams
14f-7/02 Double drive
14f-7/03 Drive by means of cam disks
14f-7/04 Transmission by means of guides
14f-7/05 Lentz gears
14f-7/06 Cam gears
14f-7/07 Meyer gears
14f-7/08 Drive by sliding curve
14f-7/09 Transmission by means of rocking levers
14f-7/10 Transmission by means of rolling contact levers
14f-8 Valve controls with positive closing and opening motion and with actuation by air, steam or liquid, also with hydraulic mechanism
14f-9 Dash pots, relieving devices and components of valve controls
14f-10 Valve arrangements at steam cylinders and valve actuators

14g Accessories for steam power engine; balancing devices for pumps and blowers without flywheels; condensers, insofar as the operation of the steam power engine is modified (17d)

14g-1 Steam admission and cut-off valves (47g)
14g-2 Starting devices for compound engines

Regulating devices for live steam operation

14g-3/01 Regulation of engines with several governors
14g-3/02 Regulation of several engines
14g-3/03 Regulation of counter-pressure engines
14g-3/04 Regulation of extraction steam engines
14g-3/05 Regulation of dual pressure engines
14g-3/06 Regulation of winding and rolling mill engines
14g-3/07 Miscellaneous regulating devices
14g-4 Regulating devices for receiver or condenser pressure

Brake and safety devices

14g-5/01 Brake devices
14g-5/02 Safety devices against excessively high or low speeds of rotation upon sudden relief, etc.
14g-5/03 Safety devices against rotation in the wrong direction
14g-5/04 Safety devices against water hammer and against the penetration of water into steam apparatus
14g-5/05 Safety devices for winding engines (35a-22; 35a-23)
14g-5/06 Safety drives for work-producing engines with two power-producing engines and reversing thereof (14c-14; 17d-5/17)
14g-5/07 Safety devices for generators driven by steam engines
14g-5/08 Testing of safety regulators in operation (14c-8/06)
14g-5/09 Vacuum breakers
14g-5/10 Safety devices operating in case of failure of the regulator or of slipping of the drive belt

14g-5/11 Devices for valves controlled by auxiliary media to provide safety against excessive pressure variations or failure of the auxiliary control media
14g-5/12 Miscellaneous safety devices
14g-6 Heating, cooling and heat insulation
14g-7 Lubrication (lubricating devices, general, 47e-7 – 47e-30)
14g-8 Oil separators (13d-30)
14g-9/01 Measuring devices
14g-9/02 Starting devices
14g-9/03 Devices for controlling the compression
14g-10 Exhausters and mufflers (46c6-1; 46c6-2; 47f-1/01; 72a-28)
14g-11 Balancing devices for engines without flywheels
14g-12 Condensation equipment, insofar as operation of the engine is affected (general 12a-6; 14c-13; 17d; 20b-14; 89e)
14g-13 Condensate pumps (general 27b, 27c, 27d)
14g-14 Removal of water from steam cylinders
14g-15 Idling devices for steam engines, e.g. idling valves, circulation valves, idling control slide valves, disengagement of coupling between the piston and the connecting rod
14g-16 Shutoff devices (47g)

14h Special equipment for the utilisation of steam energy, accumulators independent of the boiler

Return of the exhaust steam of a steam engine to the boiler, and special steam power systems (13b-25)

14h-1/01 Exhaust steam cooling
14h-1/02 Cooling of the steam in the cylinder
14h-1/03 Superheating of exhaust steam
14h-1/04 Exhaust steam distribution
14h-1/05 Steam cycle with superheating
14h-1/06 Steam cycle with cooling, compression and superheating
14h-1/07 Exhaust steam regeneration by compression
14h-1/08 Exhaust steam regeneration by means of jet blowers
14h-1/09 Return of condensate to the boiler
14h-1/10 Steam power plants operating according to the Honigmann process
14h-1/11 Subdivision of plants into different pressure stages and dual pressure plants
14h-1/12 High pressure and limit steam power plants
14h-1/13 General arrangement of complete steam power plants
14h-1/14 Miscellaneous other steam power plants
14h-2 Steam extraction from steam power engines for special purposes, e.g. for heating, drying and cooking (14c-13)
14h-3/01 Pure liquid heat accumulators and installations, expansion of hot water in balancing containers with steam development of the drive of power engines (13g-3/05)
14h-3/02 Pure steam accumulators and installations
14h-3/03 Steam accumulators with steam storage in liquids, structure and general arrangement
14h-3/04 Charging and discharging devices for heat accumulators
14h-3/05 Combination of several accumulators, charging, discharging and regulation
14h-3/06 Valves, measuring, safety, and regulating devices for heat accumulators
14h-3/07 Power plants with accumulators and dual pressure engines (14c-17)
14h-3/08 Accumulation of heat from superheated steam and accumulators with injected steam, heat exchangers
14h-3/09 Steam power plants with parallel connected accumulators
14h-3/10 Steam power plants with intermediate accumulators
14h-3/11 Accumulators with accumulator media other than water

14h-3/12	Exhaust steam and waste heat recovery (14a-19; 14c-13, 17; 24d-7; 46c6-4; 46c6-5; 46d-14; 46f-5)
14h-3/13	Superheating of accumulator discharge steam and superheating accumulators
14h-3/14	General power and heat balancing plants without accumulators
14h-3/15	Utilisation of accumulators for special purposes
14h-4/01	Intermediate superheating and direct heating of the steam (intermediate superheaters 13d)
14h-4/02	Regulating the superheating temperature
14h-4/03	Steam generation in the cylinder
14h-5	Driving of power engines by means of hot water, mixtures of steam and water, working fluid generators
14h-6	Cold steam engines with ammonia, carbon dioxide, ether or similar steams, operated as power engines and cold steam generators (as refrigeration machine 17a; condensers for cold steam engines 17d-6)
14h-7/01	power engines operated by mercury vapour; mercury vapour boilers
14h-7/02	Power engines operated by other working fluids in vapour form (apart from water and cold steam), e.g. other metal vapours, fuel vapours, vapours produced by chemical processes (insofar as the working fluids function only by expansion), also with drive by several different working fluids in vapour form; working fluid producers (for internal combustion engines 46a3, 46a6)
14h-8	Accumulation and conversion of heat energy in vapours, apart from water vapour (steam generation from liquors 13g)

14h **(IPC: 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 46f, 46g; nuclear power plants, engine arrangements therein 21g-21)

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

Steam engine plants

14h-3/00	**Plants characterised by the use of steam or heat accumulators, or intermediate steam heaters, therein** (regenerating exhaust steam 14h-19/00)
14h-3/02	. Use of accumulators and specific engine types; Regulating thereof
14h-3/04	. . the engine being of multiple-inlet-pressure type
14h-3/06	. . the engine being of extraction or non-condensing type
14h-3/08	. Use of accumulators and the plant being specially adapted for a specific use
14h-3/10	. . for vehicle drive, e.g. for accumulator locomotives
14h-3/12	. having two or more accumulators
14h-3/14	. having both steam accumulator and heater, e.g. superheating accumulator (superheating accumulators per se 14h-1/10)
14h-3/16	. . Mutual arrangement of accumulator and heater
14h-3/18	. having heaters (having both steam accumulator and heater 14h-3/14; steam heaters per se 13)

14h-3/20 . . with heating by combustion gases of main boiler
14h-3/22 . . . Controlling, e.g. starting, stopping
14h-3/24 . . with heating by separately-fired heaters
14h-3/26 . . with heating by steam

14h-5/00 Plants characterised by use of means for storing steam in an alkali to increase steam pressure, e.g. of Honigmann or Koenemann type
14h-5/02 . used in regenerative installation

14h-7/00 Plants characterised by the use of specific types of engine (14h-3/02 takes precedence)**; Plants or engines characterised by their use of special steam systems, cycles, or processes** (reciprocating-piston engines using uniflow principle 14a-17/04)**; Regulating means peculiar to such systems, cycles, or processes; Use of withdrawn or exhaust steam for feed-water heating**
14h-7/02 . the engines being of multiple-expansion type (the engines being only of turbine type 14h-7/16; the engines using steam of critical or over-critical pressure 14h-7/32; the engines being of extraction or non-condensing type 14h-7/34)
14h-7/04 . . Regulating means peculiar thereto
14h-7/06 . the engines being of multiple-inlet-pressure type (14h-7/02 takes precedence; the engines being only of turbine type 14h-7/16; the engines using steam of critical or over-critical pressure 14h-7/32; the engines being of extraction or non-condensing type 14h-7/34)
14h-7/08 . . Regulating means peculiar thereto
14h-7/10 . characterised by the engine exhaust pressure (the engines being only of turbine type 14h-7/16; the engines using steam of critical or over-critical pressure 14h-7/32; the engines being of extraction or non-condensing type 14h-7/34)
14h-7/12 . . of condensing type
14h-7/14 . . . Regulating means peculiar thereto
14h-7/16 . the engines being only of turbine type (the engines using steam of critical or over-critical pressure 14h-7/32; the engines being of extraction or non-condensing type 14h-7/34)
14h-7/18 . . the turbine being of multiple-inlet-pressure type
14h-7/20 . . . Regulating means peculiar thereto
14h-7/22 . . the turbines having inter-stage steam heating
14h-7/24 . . . Regulating or safety means peculiar thereto
14h-7/26 . . the turbines having inter-stage steam accumulation
14h-7/28 . . . Regulating means peculiar thereto
14h-7/30 . . the turbines using exhaust steam only
14h-7/32 . the engines using steam of critical or over-critical pressure
14h-7/34 . the engines being of extraction or non-condensing type; Use of steam for feed-water heating (feed-water heaters per se 13b)
14h-7/36 . . the engines being of positive-displacement type
14h-7/38 . . the engines being of turbine type
14h-7/40 . . Use of two or more feed-water heaters in series
14h-7/42 . . Use of desuperheaters for feed-water heating
14h-7/44 . . Use of steam for feed-water heating and another purpose

14h-9/00 Plants characterised by condensers arranged or modified to co-operate with the engines (by condensers structurally combined with engines 14h-11/00; steam condensers per se 17d)
14h-9/02 . Arrangements or modifications of condensate or air pumps
14h-9/04 . with dump valves to by-pass stages

14h-11/00 Plants characterised by the engines being structurally combined with boilers or condensers
14h-11/02 . the engines being turbines
14h-11/04 . the boilers or condensers being rotated in use

14h-13/00 General layout or general methods of operation, of complete plants
14h-13/02 . Regulating, e.g. stopping or starting

14h-15/00 Adaptations of plants for special use
14h-15/02 . for driving vehicles, e.g. locomotives (arrangements in vehicles, see the relevant vehicle classes)
14h-15/04 . . the vehicles being waterborne vessels

14h-17/00 Using steam or condensate extracted or exhausted from steam engine plant (for heating feed-water 14h-7/34; returning condensate to boiler 13b)
14h-17/02 . for heating purposes, e.g. industrial, domestic (14h-17/06 takes precedence;
14h-17/04 . for specific purposes other than heating (14h-17/06 takes precedence)
14h-17/06 . Returning energy of steam, in exchanged form, to process, e.g. use of exhaust steam for drying solid fuel of plant

14h-19/00 Regenerating or otherwise treating steam exhausted from steam engine plant (plants characterised by use of means for storing steam in an alkali to increase steam pressure 14h-5/00; returning condensate to boiler 13b)
14h-19/02 . Regenerating by compression
14h-19/04 . . in combination with cooling or heating
14h-19/06 . . in engine cylinder
14h-19/08 . . compression done by injection apparatus, jet blower, or the like
14h-19/10 . Cooling exhaust steam other than by condenser; Rendering exhaust steam invisible

14h-21/00 Steam engine plants not otherwise provided for
14h-21/02 . with steam generation in engine cylinders
14h-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 per se 13a)
14h-21/06 . Treating live steam, other than thermodynamically, e.g. for fighting deposits in engine

14h-23/00 Plants characterised by more than one engine delivering power external to the plant, the engines being driven by different fluids
14h-23/02 . the engine cycles being thermally coupled
14h-23/04 . . condensation heat from one cycle heating the fluid in another cycle
14h-23/06 . . combustion heat from one cycle heating the fluid in another cycle
14h-23/08 . . . with working fluid of one cycle heating the fluid in another cycle
14h-23/10 . . . with exhaust fluid of one cycle heating the fluid in another cycle
14h-23/12 . the engines being mechanically coupled (14h-23/02 takes precedence)
14h-23/14 . . including at least one combustion engine
14h-23/16 . . all the engines being turbines (14h-23/14 takes precedence)
14h-23/18 . characterised by adaptation for specific use

14h-25/00 Plants or engines characterised by use of special working fluids, not otherwise provided for; Plants operating enclosed cycles and not otherwise provided for
14h-25/02 . the fluid remaining in the liquid phase
14h-25/04 . the fluid being in different phases, e.g. foamed
14h-25/06 . using mixtures of different fluids (plants using mixtures of steam and gas 14h-21/04)
14h-25/08 . using special vapours
14h-25/10 . . the vapours being cold, e.g. ammonia, carbon dioxide, ether
14h-25/12 . . the vapours being metallic, e.g. mercury
14h-25/14 . . using industrial or other waste gases

14h-27/00 Plants for converting heat or fluid energy into mechanical energy, not otherwise provided for
14h-27/02 . Plants modified to use their waste heat, other than that of exhaust, e.g. engine-friction heat

14i (IPC: F01M) Lubricating of machines or engines in general (lubricating in general 47e)**; Lubricating internal-combustion engines**

14i-1/00 Pressure lubrication
14i-1/02 . using lubricating pumps (pumps in general 59; lubricating pumps per se 47e)

14i-1/04	. using pressure in working cylinder or crankcase to operate lubricant-feeding devices
14i-1/06	. Lubricating systems characterised by the provision therein of crankshafts or connecting-rods with lubricant passageways, e.g. bores (crankshafts, connecting-rods, per se 47b)
14i-1/08	. Lubricating systems characterised by the provision therein of lubricant-jetting means
14i-1/10	. Lubricating systems characterised by the provision therein of lubricant venting or purifying means, e.g. of filters
14i-1/12	. Closed-circuit lubricating systems not provided for in groups 14i-1/02 to 14i-1/10
14i-1/14	. Timed lubrication (14i-1/08 takes precedence)
14i-1/16	. Controlling lubricant pressure or quantity (rendering machines or engines inoperative or idling on lubricant-pressure failure 14i-1/22)
14i-1/18	. Indicating or safety devices (concerning lubricant level 14i-11/06, 14i-11/12)
14i-1/20	. . concerning lubricant pressure
14i-1/22	. . . rendering machines or engines inoperative or idling on pressure failure
14i-1/24	. . . . acting on engine fuel system
14i-1/26	. . . . acting on engine ignition system
14i-1/28	. . . . acting on engine combustion-air supply
14i-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 14i-11/08)
14i-3/02	. with variable proportion of lubricant to fuel, lubricant to air, or lubricant to fuel-air mixture
14i-3/04	. for upper cylinder lubrication only
14i-5/00	**Heating, cooling, or controlling temperature of lubricant** (arrangement of lubricant coolers in engine cooling system 14l-11/08)**; Lubrication means facilitating engine starting**
14i-5/02	. Conditioning lubricant for aiding engine starting, e.g. heating
14i-5/04	. . Diluting, e.g. with fuel
14i-7/00	**Lubrication means specially adapted for machine or engine running-in**
14i-9/00	**Lubrication means having pertinent characteristics not provided for in, or of interest apart from, groups 14i-1/00 to 14i-7/00**
14i-9/02	. having means for introducing additives to lubricant
14i-9/04	. Use of fuel as lubricant
14i-9/06	. Dip or splash lubrication
14i-9/08	. Drip lubrication
14i-9/10	. Lubrication of valve gear or auxiliaries
14i-9/12	. Non-pressurised lubrication, or non-closed-circuit lubrication, not otherwise provided for
14i-11/00	**Component parts, details, or accessories, not provided for in, or of interest apart from, groups 14i-1/00 to 14i-9/00**
14i-11/02	. Arrangements of lubricant conduits
14i-11/04	. Filling or draining lubricant of or from machines or engines
14i-11/06	. Means for keeping lubricant level constant or for accommodating movement or position of machines or engines
14i-11/08	. Separating lubricant from air or fuel-air mixture before entry into cylinder (separating in general 26d)
14i-11/10	. Indicating devices; Other safety devices
14i-11/12	. . concerning lubricant level

14k	**(IPC: F01N) Gas-flow silencers or exhaust apparatus for machines or engines in general; Gas-flow silencers or exhaust apparatus for internal combustion engines** (combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines 46c-35/00; protecting against, or damping, noise in general 42g-1/10)
14k-1/00	**Silencing apparatus characterised by method of silencing**
14k-1/02	. by using resonance
14k-1/04	. . having sound-absorbing materials in resonance chambers
14k-1/06	. by using interference effect
14k-1/08	. by reducing exhaust energy by throttling or whirling
14k-1/10	. . in combination with sound-absorbing materials
14k-1/12	. . using spirally- or helically-shaped channels (14k-1/10 takes precedence; cyclones 50e-3/10)
14k-1/14	. by adding air to exhaust gases
14k-1/16	. by using movable parts
14k-1/18	. . having rotary movement
14k-1/20	. . having oscillating or vibrating movement (the parts being resilient walls 14k-1/22)
14k-1/22	. . the parts being resilient walls
14k-1/24	. by using sound-absorbing materials (14k-1/04, 14k-1/06, 14k-1/10, 14k-1/14, 14k-1/16 take precedence)
14k-3/00	**Exhaust or silencing apparatus having means for purifying, rendering innocuous, or otherwise treating exhaust**
14k-3/02	. for cooling, or for removing solid constituents of, exhaust
14k-3/04	. . using liquids
14k-3/06	. for extinguishing sparks
14k-3/08	. for rendering innocuous
14k-3/10	. . by burning, e.g. by after-burning using additional air
14k-3/12	. . . adding fuel (14k-3/14 takes precedence)
14k-3/14	. . . having igniting means, e.g. catalysts
14k-3/16	. . by other chemical processes
14k-5/00	**Exhaust or silencing apparatus combined or associated with devices profiting by exhaust energy** (predominant aspects of such devices, see the relevant classes for the devices; using kinetic or wave energy of exhaust gases in exhaust systems for charging 46a)
14k-5/02	. the devices using heat
14k-5/04	. the devices using kinetic energy
14k-7/00	**Exhaust or silencing apparatus, or parts thereof, having pertinent characteristics not provided for in, or of interest apart from, groups 14k-1/00 to 14k-5/00**
14k-7/02	. Apparatus having two or more separate silencers in series
14k-7/04	. Apparatus having two or more silencers in parallel for multi-cylinder engines, e.g. having interconnections
14k-7/06	. specially adapted for star-arrangement of cylinders, e.g. exhaust manifolds
14k-7/08	. Other arrangements or adaptations of exhaust conduits (pipes in general 47f1)
14k-7/10	. . of exhaust manifolds
14k-7/12	. specially adapted for submerged exhausting
14k-7/14	. having thermal insulation
14k-7/16	. Selection of particular materials
14k-7/18	. Construction facilitating manufacture, assembly, or disassembly
14k-7/20	. Flared outlets, e.g. of fish-tail shape

14l **(IPC: F01P) Cooling of machines or engines in general** (lubricating in general 47e)**; Cooling of internal-combustion engines** (heat exchange in general, radiators 17e, 17f)

Notes
1. Cooling by lubricant is classified in subclass 14i when the lubrication aspect predominates, and in subclass 14l when the cooling aspect predominates.
2. In this subclass: The following terms are used with the meanings indicated:
(a) "Air" includes other gaseous cooling fluids.
(b) "Liquid cooling" also embraces cooling where liquid is used as the heat-transferring fluid between parts to be cooled and the air, e.g. using radiators.
(c) "Air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained under (b).
(d) "Cooling-air" embraces directly- or indirectly-acting cooling-air.

Air cooling; Liquid cooling (propelling cooling-air or liquid coolants 14l-5/00; controlling supply or circulation of coolants 14l-7/00; cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts per se, modified to facilitate cooling, see the relevant classes for such parts)

14l-1/00 **Air cooling**
14l-1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders
14l-1/04 . Arrangements for cooling pistons
14l-1/06 . Arrangements for cooling other engine or machine parts
14l-1/08 . . for cooling intake or exhaust valves
14l-1/10 . . for cooling fuel injectors or sparking-plugs

14l-3/00 **Liquid cooling**
14l-3/02 . Arrangements for cooling cylinders or cylinder heads
14l-3/04 . . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads
14l-3/06 . Arrangements for cooling pistons
14l-3/08 . . Cooling of piston exterior only, e.g. by jets
14l-3/10 . . Cooling by flow of coolant through pistons
14l-3/12 . Arrangements for cooling other engine or machine parts
14l-3/14 . . for cooling intake or exhaust valves
14l-3/16 . . for cooling fuel injectors or sparking-plugs
14l-3/18 . Arrangement or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads 14l-3/04; relative to vehicles 63c-72)
14l-3/20 . Cooling circuits not specific to a single part of engine or machine (14l-3/22 takes precedence)
14l-3/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation 14l-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

14l-5/00 **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps 14l-7/00)
14l-5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
14l-5/04 . . Pump-driving arrangements
14l-5/06 . . Guiding or ducting air to or from ducted fans
14l-5/08 . . Use of engine exhaust gases for pumping cooling-air
14l-5/10 . Pumping liquid coolant; Arrangements of coolant pumps
14l-5/12 . . Pump-driving arrangements

14l-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
14l-7/00	**Controlling of coolant flow**
14l-7/02	. the coolant being cooling-air
14l-7/04	. . by varying pump speed, e.g. by changing pump-drive gear ratio
14l-7/06	. . by varying blade pitch
14l-7/08	. . by cutting in or out of pumps
14l-7/10	. . by throttling amount of air flowing through liquid-to-air heat-exchangers
14l-7/12	. . . by thermostatic control
14l-7/14	. the coolant being liquid
14l-7/16	. . by thermostatic control
14l-9/00	**Cooling having pertinent characteristics not provided for in, or of interest apart from, groups 14l-1/00 to 14l-7/00** (profiting from waste heat of combustion-engine cooling 46d)
14l-9/02	. Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles 14l-3/22)
14l-9/04	. by simultaneous or alternative use of direct air cooling and liquid cooling (14l-9/02 takes precedence)
14l-9/06	. by use of refrigerating apparatus, e.g. of compressor or absorber type
14l-11/00	**Component parts, details, or accessories, not provided for in, or of interest apart from, groups 14l-1/00 to 14l-9/00**
14l-11/02	. Liquid-coolant overflow, venting, or draining devices (automatic draining during freezing conditions 14l-11/20)
14l-11/04	. Arrangements of liquid pipes or hoses
14l-11/06	. Cleaning (in general 12d, 12e); Combating corrosion (in general 48d1)
14l-11/08	. Arrangements of lubricant coolers (in lubrication apparatus 14i)
14l-11/10	. Guiding or ducting cooling-air to or from liquid-to-air heat-exchangers
14l-11/12	. Filtering, cooling, or silencing cooling-air
14l-11/14	. Indicating devices; Other safety devices
14l-11/16	. . concerning coolant temperature (14l-11/20 takes precedence)
14l-11/18	. . concerning coolant pressure, coolant flow, or liquid-coolant level
14l-11/20	. . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather