SECTION H — ELECTRICITY

H02 GENERATION, CONVERSION, OR DISTRIBUTION OF ELECTRIC POWER

H02K **DYNAMO-ELECTRIC MACHINES** (dynamo-electric relays H01H 53/00; conversion of DC or AC input power into surge output power H02M 9/00)

Note(s)

1. This subclass covers the structural adaptation of dynamo-electric machines for the purpose of their control.
2. This subclass does not cover starting, regulating, electronically commutating, braking, or otherwise controlling motors, generators or dynamo-electric converters, in general, which is covered by subclass H02P.
3. Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".

Subclass index

1/00 **Details of the magnetic circuit** (magnetic circuits for relays H01H 50/16)

1/02 • characterised by the magnetic material

1/04 • characterised by the material used for insulating the magnetic circuit or parts thereof

1/06 • characterised by the shape, form or construction

1/08 • • Salient poles

1/10 • • • Commutating poles

1/12 • • Stationary parts of the magnetic circuit

1/14 • • • Stator cores with salient poles

1/16 • • • Stator cores with slots for windings

1/17 • • • Stator cores with permanent magnets **[5]**

1/18 • • • Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures

1/20 • • • with channels or ducts for flow of cooling medium

1/22 • • Rotating parts of the magnetic circuit

1/24 • • • Rotor cores with salient poles

1/26 • • • Rotor cores with slots for windings

1/27 • • • Rotor cores with permanent magnets **[5]**

1/28 • • • Means for mounting or fastening rotating magnetic parts on to, or to, the rotor structures

1/30 • • • • using intermediate parts, e.g. spiders

1/32 • • • with channels or ducts for flow of cooling medium

1/34 • • Reciprocating, oscillating or vibrating parts of the magnetic circuit

3/00 **Details of windings**

3/02 • Windings characterised by the conductor material

3/04 • Windings characterised by the conductor shape, form or construction, e.g. with bar conductors

3/12 • • arranged in slots

3/14 • • • with transposed conductors, e.g. twisted conductors
3/16 • • • for auxiliary purposes, e.g. damping or commutating
3/18 • • Windings for salient poles
3/20 • • • for auxiliary purposes, e.g. damping or commutating
3/22 • • consisting of hollow conductors
3/24 • • with channels or ducts for cooling medium between the conductors
3/26 • • consisting of printed conductors
3/28 • • Layout of windings or of connections between windings (windings for pole-changing H02K 17/06, H02K 17/14, H02K 19/12, H02K 19/32)
3/30 • Windings characterised by the insulating material
3/32 • Windings characterised by the shape, form or construction of the insulation
3/34 • • between conductors or between conductor and core, e.g. slot insulation **[3]**
3/38 • • around winding heads, equalising connectors, or connections thereto
3/40 • • for high voltage, e.g. affording protection against corona discharges
3/42 • Means for preventing or reducing eddy-current losses in the winding heads, e.g. by shielding **[2]**
3/44 • Protection against moisture or chemical attack; Windings specially adapted for operation in liquid or gas
3/46 • Fastening of windings on the stator or rotor structure
3/47 • • Air-gap windings, i.e. iron-free windings **[3]**
3/48 • • in slots
3/487 • • • Slot-closing devices **[3]**
3/493 • • • • magnetic **[3]**
3/50 • • Fastening of winding heads, equalising connectors, or connections thereto
3/51 • • • applicable to rotors only **[3]**
3/52 • • Fastening salient pole windings or connections thereto

5/00 Casings; Enclosures; Supports

5/02 • Casings or enclosures characterised by the material thereof
5/04 • Casings or enclosures characterised by the shape, form or construction thereof
5/06 • • Cast metal casings
5/08 • • Insulating casings
5/10 • • with arrangements for protection from ingress, e.g. of water or fingers
5/12 • • specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00)
5/124 • • • Sealing of shafts **[3]**
5/128 • • • using air-gap sleeves or air-gap discs **[3]**
5/132 • • • Submersible electric motors (H02K 5/128 takes precedence) **[3]**
5/136 • • • explosion-proof **[3]**
5/14 • • Means for supporting or protecting brushes or brush holders **[3]**
5/15 • • Mounting arrangements for bearing-shields or end plates **[3]**
5/16 • • Means for supporting bearings, e.g. insulating supports or means for fitting bearings in the bearing-shields (magnetic bearings H02K 7/09)
5/167 • • • using sliding-contact or spherical cap bearings **[3]**
5/173 • • • using bearings with rolling contact, e.g. ball bearings **[3]**
5/18 • • with ribs or fins for improving heat transfer
5/20 • • with channels or ducts for flow of cooling medium
5/22 • • Auxiliary parts of casings not covered by groups H02K 5/06-H02K 5/20, e.g. shaped to form connection boxes or terminal boxes
5/24 • specially adapted for suppression or reduction of noise or vibrations
5/26 • Means for adjusting casings relative to their supports

7/00 Arrangements for handling mechanical energy structurally associated with dynamo-electric machines, e.g. structural association with mechanical driving motors or auxiliary dynamo-electric machines

7/02 • Additional mass for increasing inertia, e.g. flywheels
7/04 • Balancing means
7/06 • Means for converting reciprocating motion into rotary motion or vice versa
7/065 • • Electromechanical oscillators; Vibrating magnetic drives **[3]**
7/07 • • using pawls and ratchet wheels **[3]**
7/075 • • using crankshafts or eccentrics **[3]**
7/08 • Structural association with bearings
7/09 • • with magnetic bearings **[3]**
7/10 • Structural association with clutches, brakes, gears, pulleys or mechanical starters
7/102 • • with friction brakes
7/104 • • with eddy-current brakes
7/106 • • with dynamo-electric brakes
7/108 • • with friction clutches
7/11 • • with dynamo-electric clutches
7/112 • • with friction clutches in combination with brakes
7/114 • • with dynamo-electric clutches in combination with brakes
7/116 • • with gears
7/118 • • with starting devices
7/12 • • with auxiliary limited movement of stators, rotors or core parts, e.g. rotors axially movable for the purpose of clutching or braking
7/14 • Structural association with mechanical loads, e.g. with hand-held machine tools or fans (with fan or impeller for cooling the machine H02K 9/06)
7/16 • • for operation above the critical speed of vibration of the rotating parts
7/18 • Structural association of electric generators with mechanical driving motors, e.g.with turbines
7/20 • Structural association with auxiliary dynamo-electric machines, e.g. with electric starter motors or exciters

9/00 Arrangements for cooling or ventilating (channels or ducts in parts of the magnetic circuit H02K 1/20, H02K 1/32; channels or ducts in or between conductors H02K 3/22, H02K 3/24)

9/02 • by ambient air flowing through the machine
9/04 • • having means for generating a flow of cooling medium
9/06 • • • with fans or impellers driven by the machine shaft
9/08 • by gaseous cooling medium circulating wholly within the machine casing (H02K 9/10 takes precedence)
9/10 • by gaseous cooling medium flowing in closed circuit, a part of which is external to the machine casing
9/12 • • wherein the cooling medium circulates freely within the casing

9/14 • wherein gaseous cooling medium circulates between the machine casing and a surrounding mantle
9/16 • • wherein the cooling medium circulates through ducts or tubes within the casing
9/18 • • wherein the external part of the closed circuit comprises a heat exchanger structurally associated with the machine casing
9/19 • for machines with closed casing and closed-circuit cooling using a liquid cooling medium, e.g. oil
9/193 • • with provision for replenishing the cooling medium; with means for preventing leakage of the cooling medium
9/197 • • in which the rotor or stator space is fluid-tight, e.g. to provide for different cooling media for rotor and stator
9/20 • • wherein the cooling medium vaporises within the machine casing
9/22 • by solid heat conducting material embedded in, or arranged in contact with, the stator or rotor, e.g. heat bridges
9/24 • Protection against failure of cooling arrangements, e.g. due to loss of cooling medium or due to interruption of the circulation of cooling medium
9/26 • Structural association of machines with devices for cleaning or drying cooling medium, e.g. with filters
9/28 • Cooling of commutators, slip-rings or brushes, e.g. by ventilating

11/00 Structural association of dynamo-electric machines with measuring or protective devices or electric components, e.g. with resistors or switches
11/02 • for suppression of radio interference **[6]**
11/04 • for rectification **[6]**

13/00 Structural associations of current collectors with motors or generators, e.g. brush mounting plates or connections to windings (supporting or protecting brushes or brush holders in motor casings or enclosures H02K 5/14)**; Disposition of current collectors in motors or generators; Arrangements for improving commutation**
13/02 • Connections between slip-rings and windings
13/04 • Connections between commutator segments and windings
13/06 • • Resistive connections, e.g. by high-resistance chokes or by transistors
13/08 • • Segments formed by extensions of the winding
13/10 • Arrangements of brushes or commutators specially adapted for improving commutation
13/12 • Arrangements for producing an axial reciprocation of the rotor and its associated current collector part, e.g. for polishing commutator surfaces
13/14 • Circuit arrangements for improvement of commutation, e.g. by use of unidirectionally conductive elements

15/00 Methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing of dynamo-electric machines
15/02 • of stator or rotor bodies
15/03 • • having permanent magnets **[5]**
15/04 • of windings, prior to mounting into machines (insulating windings H02K 15/10, H02K 15/12)
15/06 • Embedding prefabricated windings in machines
15/08 • Forming windings by laying conductors into or around core parts
15/085 • • by laying conductors into slotted stators
15/09 • • by laying conductors into slotted rotors
15/095 • • by laying conductors around salient poles
15/10 • Applying solid insulation to windings, stators or rotors
15/12 • Impregnating, heating or drying of windings, stators, rotors or machines
15/14 • Casings; Enclosures; Supports
15/16 • Centering rotors within the stator; Balancing rotors

16/00 Machines with more than one rotor or stator [2]
16/02 • Machines with one stator and two rotors **[2]**
16/04 • Machines with one rotor and two stators **[2]**

Note(s)

Group H02K 16/00 takes precedence over groups H02K 17/00-H02K 53/00.

17/00 Asynchronous induction motors; Asynchronous induction generators
17/02 • Asynchronous induction motors
17/04 • • for single phase current
17/06 • • • having windings arranged for permitting pole-changing
17/08 • • • Motors with auxiliary phase obtained by externally fed auxiliary windings, e.g. capacitor motors
17/10 • • • Motors with auxiliary phase obtained by split-pole carrying short-circuited windings
17/12 • • for multi-phase current
17/14 • • • having windings arranged for permitting pole-changing
17/16 • • having rotors with internally short-circuited windings, e.g. cage rotors
17/18 • • • having double-cage or multiple-cage rotors
17/20 • • • having deep-bar rotors
17/22 • • having rotors with windings connected to slip-rings
17/24 • • • in which both stator and rotor are fed with AC
17/26 • • having rotors or stators designed to permit synchronous operation
17/28 • • having compensating winding for improving phase angle
17/30 • • Structural association of asynchronous induction motors with auxiliary electric devices influencing the characteristics of the motor or controlling the motor, e.g. with impedances or switches
17/32 • • Structural association of asynchronous induction motors with auxiliary mechanical devices, e.g. with clutches or brakes
17/34 • • Cascade arrangement of an asynchronous motor with another dynamo-electric motor or converter
17/36 • • • with another asynchronous induction motor
17/38 • • • with a commutator machine
17/40 • • • with a rotary AC/DC converter
17/42 • Asynchronous induction generators (H02K 17/02 takes precedence) **[4]**
17/44 • • Structural association with exciting machines

19/00 Synchronous motors or generators (having permanent magnets H02K 21/00)
19/02 • Synchronous motors
19/04 • • for single-phase current
19/06 • • • Motors having windings on the stator and a variable-reluctance soft-iron rotor without windings, e.g. inductor motors
19/08 • • • Motors having windings on the stator and a smooth rotor without windings of material with large hysteresis, e.g. hysteresis motors

19/10 • • for multi-phase current
19/12 • • • characterised by the arrangement of exciting windings, e.g. for self-excitation, compounding or pole-changing
19/14 • • having additional short-circuited windings for starting as asynchronous motors
19/16 • Synchronous generators
19/18 • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generators
19/20 • • • with variable-reluctance soft-iron rotors without winding
19/22 • • having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generators
19/24 • • • with variable-reluctance soft-iron rotors without winding
19/26 • • characterised by the arrangement of exciting windings
19/28 • • • for self-excitation
19/30 • • • for compounding
19/32 • • • for pole-changing
19/34 • • Generators with two or more outputs
19/36 • • Structural association of synchronous generators with auxiliary electric devices influencing the characteristic of the generator or controlling the generator, e.g. with impedances or switches
19/38 • • Structural association of synchronous generators with exciting machines

21/00 Synchronous motors having permanent magnets; Synchronous generators having permanent magnets

21/02 • Details
21/04 • • Windings on magnets for additional excitation
21/10 • • Rotating armatures
21/12 • with stationary armatures and rotating magnets
21/14 • • with magnets rotating within the armatures
21/16 • • • having annular armature cores with salient poles (with homopolar co-operation H02K 21/20)
21/18 • • • having horse-shoe armature cores (with homopolar co-operation H02K 21/20)
21/20 • • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine
21/22 • • with magnets rotating around the armatures, e.g. flywheel magnetos
21/24 • • with magnets axially facing the armatures, e.g. hub-type cycle dynamos
21/26 • with rotating armatures and stationary magnets
21/28 • • with armatures rotating within the magnets
21/30 • • • having annular armature cores with salient poles (with homopolar co-operation H02K 21/36)
21/32 • • • having horse-shoe magnets (with homopolar co-operation H02K 21/36)
21/34 • • • having bell-shaped or bar-shaped magnets, e.g. for cycle lighting (with homopolar co-operation H02K 21/36)
21/36 • • • with homopolar co-operation
21/38 • with rotating flux distributors, and armatures and magnets both stationary
21/40 • • with flux distributors rotating around the magnets and within the armatures
21/42 • • with flux distributors rotating around the armatures and within the magnets
21/44 • • with armature windings wound upon the magnets
21/46 • Motors having additional short-circuited winding for starting as an asynchronous motor
21/48 • Generators with two or more outputs

23/00 DC commutator motors or generators having mechanical commutator; Universal AC/DC commutator motors

23/02 • characterised by arrangement for exciting
23/04 • • having permanent magnet excitation
23/06 • • having shunt connection of excitation windings
23/08 • • having series connection of excitation windings
23/10 • • having compound connection of excitation windings
23/12 • • having excitation produced by current sources independent of the armature circuit
23/14 • • having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field
23/16 • • having angularly adjustable excitation field, e.g. by pole reversing or pole switching
23/18 • • having displaceable main or auxiliary brushes
23/20 • • having additional brushes spaced intermediately of the main brushes on the commutator, e.g. cross-field machines, metadynes, amplidynes or other armature-reaction excited machines
23/22 • • having compensating or damping windings
23/24 • • having commutating-pole windings
23/26 • characterised by the armature windings
23/28 • • having open windings, i.e. not closed within the armatures
23/30 • • having lap windings; having loop windings
23/32 • • having wave winding; having undulating winding
23/34 • • having mixed windings
23/36 • • having two or more windings; having two or more commutators; having two or more stators
23/38 • • having winding or connection for improving commutation, e.g. equipotential connection
23/40 • characterised by the arrangement of the magnet circuits
23/42 • • having split poles, i.e. zones for varying reluctance by gaps in poles or by poles with different spacing of the air gap
23/44 • • having movable, e.g. turnable, iron parts
23/46 • • having stationary shunts, i.e. magnetic cross flux
23/48 • • having adjustable armatures
23/50 • Generators with two or more outputs
23/52 • Motors acting also as generators, e.g. starting motors used as generators for ignition or lighting
23/54 • Disc armature motors or generators
23/56 • Motors or generators having iron cores separated from armature winding
23/58 • Motors or generators without iron cores
23/60 • Motors or generators having rotating armatures and rotating excitation field
23/62 • Motors or generators with stationary armatures and rotating excitation field
23/64 • Motors specially adapted for running on DC or AC by choice
23/66 • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine, e.g. with impedances or switches
23/68 • Structural association with auxiliary mechanical devices, e.g. with clutches or brakes

24/00 Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn

25/00 DC interrupter motors or generators

26/00 Machines adapted to function as torque motors, i.e. to exert a torque when stalled

27/00 AC commutator motors or generators having mechanical commutator

27/02 • characterised by the armature winding
27/04 • having single-phase operation in series or shunt connection
27/06 • • with a single or multiple short-circuited commutator, e.g. repulsion motor
27/08 • • with multiple-fed armature
27/10 • • with switching devices for different modes of operation, e.g. repulsion-induction motor
27/12 • having multi-phase operation
27/14 • • in series connection
27/16 • • in shunt connection with stator feeding
27/18 • • in shunt connection with rotor feeding
27/20 • Structural association with a speed regulating device
27/22 • having means for improving commutation, e.g. auxiliary fields, double windings, double brushes
27/24 • having two or more commutators
27/26 • having disc armature
27/28 • Structural association with auxiliary electric devices influencing the characteristic of the machine or controlling the machine
27/30 • Structural association with auxiliary mechanical devices, e.g. with clutches or brakes

29/00 Motors or generators having non-mechanical commutating devices, e.g. discharge tubes or semiconductor devices

29/03 • with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems **[6]**
29/06 • with position sensing devices (H02K 29/03 takes precedence) **[4, 6]**
29/08 • • using magnetic effect devices, e.g. Hall-plates or magneto-resistors (H02K 29/12 takes precedence) **[4]**
29/10 • • using light effect devices **[4]**
29/12 • • using detecting coils **[4]**
29/14 • with speed sensing devices (H02K 29/03 takes precedence) **[4, 6]**

31/00 Acyclic motors or generators, i.e. DC machines having drum or disc armatures with continuous current collectors

31/02 • with solid-contact collectors
31/04 • with at least one liquid-contact collector

33/00 Motors with reciprocating, oscillating or vibrating magnet, armature or coil system (arrangements for handling mechanical energy structurally associated with motors H02K 7/00, e.g. H02K 7/06)

33/02 • with armatures moved one way by energisation of a single coil system and returned by mechanical force, e.g. by springs
33/04 • • wherein the frequency of operation is determined by the frequency of uninterrupted AC energisation
33/06 • • • with polarised armatures
33/08 • • • with DC energisation superimposed on AC energisation
33/10 • • wherein the alternate energisation and de-energisation of the single coil system is effected or controlled by movement of the armatures
33/12 • with armatures moving in alternate directions by alternate energisation of two coil systems
33/14 • • wherein the alternate energisation and de-energisation of the two coil systems are effected or controlled by movement of the armatures
33/16 • with polarised armatures moving in alternate directions by reversal or energisation of a single coil system
33/18 • with coil systems moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnets

35/00 Generators with reciprocating, oscillating or vibrating coil system, magnet, armature or other part of the magnetic circuit (arrangements for handling mechanical energy structurally associated with generators H02K 7/00, e.g. H02K 7/06)

35/02 • with moving magnets and stationary coil systems
35/04 • with moving coil systems and stationary magnets
35/06 • with moving flux distributors, and both coil systems and magnets stationary

37/00 Motors with rotor rotating step by step and without interrupter or commutator driven by the rotor, e.g. stepping motors

37/02 • of variable reluctance type **[4]**
37/04 • • with rotors situated within the stators **[4]**
37/06 • • with rotors situated around the stators **[4]**
37/08 • • with rotors axially facing the stators **[4]**
37/10 • of permanent magnet type (H02K 37/02 takes precedence) **[4]**
37/12 • • with stationary armatures and rotating magnets **[4]**
37/14 • • • with magnets rotating within the armatures **[4]**
37/16 • • • • having horseshoe armature cores **[4]**
37/18 • • • • of homopolar type **[4]**
37/20 • • with rotating flux distributors, the armatures and magnets both being stationary **[4]**
37/22 • Damping units **[4]**
37/24 • Structural association with auxiliary mechanical devices **[4]**

39/00 Generators specially adapted for producing a desired non-sinusoidal waveform

41/00 Propulsion systems in which a rigid body is moved along a path due to dynamo-electric interaction between the body and a magnetic field travelling along the path

41/02 • Linear motors; Sectional motors **[3]**
41/025 • • Asynchronous motors **[3]**
41/03 • • Synchronous motors; Motors moving step by step; Reluctance motors (H02K 41/035 takes precedence) **[3]**
41/035 • • DC motors; Unipolar motors **[3]**
41/06 • Rolling motors, i.e. motors having the rotor axis parallel to the stator axis and following a circular path as the rotor rolls around the inside or outside of the stator

44/00 Machines in which the dynamo-electric interaction between a plasma or flow of conductive liquid or of fluid-borne conductive or magnetic particles and a coil system or magnetic field converts energy of mass flow into electrical energy or vice versa [3]

44/02 • Electrodynamic pumps **[3]**

44/04 • • Conduction pumps **[3]**
44/06 • • Induction pumps **[3]**
44/08 • Magnetohydrodynamic [MHD] generators **[3]**
44/10 • • Constructional details of electrodes **[3]**
44/12 • • Constructional details of fluid channels **[3]**
44/14 • • • Circular or screw-shaped channels **[3]**
44/16 • • Constructional details of the magnetic circuits **[3]**
44/18 • • for generating AC power **[3]**
44/20 • • • by changing the polarity of the magnetic field **[3]**
44/22 • • • by changing the conductivity of the fluid **[3]**
44/24 • • • by reversing the direction of fluid **[3]**
44/26 • • • by creating a travelling magnetic field **[3]**
44/28 • Association of MHD generators with conventional generators (nuclear power plants including a MHD generator G21D 7/02) **[3]**

47/00 Dynamo-electric converters
47/02 • AC/DC converters or vice versa
47/04 • • Motor/generators
47/06 • • Cascade converters
47/08 • • Single-armature converters
47/10 • • • with booster machines on the AC side
47/12 • DC/DC converters
47/14 • • Motor/generators
47/16 • • Single-armature converters, e.g. metadyne
47/18 • AC/AC converters
47/20 • • Motor/generators
47/22 • • Single-armature frequency converters with or without phase-number conversion
47/24 • • • having windings for different numbers of poles
47/26 • • • operating as under- or over-synchronously running asynchronous induction machines, e.g. cascade arrangement of asynchronous and synchronous machines
47/28 • • • operating as commutator machines with added slip-rings
47/30 • • Single-armature phase-number converters without frequency conversion

49/00 Dynamo-electric clutches; Dynamo-electric brakes
49/02 • of the asynchronous induction type
49/04 • • of the eddy-current hysteresis type
49/06 • of the synchronous type
49/08 • of the collector armature type
49/10 • of the permanent-magnet type
49/12 • of the acyclic type

51/00 Dynamo-electric gears, i.e. dynamo-electric means for transmitting mechanical power from a driving shaft to a driven shaft and comprising structurally interrelated motor and generator parts

53/00 Alleged dynamo-electric perpetua mobilia

55/00 Dynamo-electric machines having windings operating at cryogenic temperatures [3]
55/02 • of the synchronous type **[3]**
55/04 • • with rotating field windings **[3]**
55/06 • of the homopolar type **[3]**

99/00 Subject matter not provided for in other groups of this subclass [2014.01]