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 the machines for the purposes 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 are 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 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 part or parts, e.g. spider

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

1/34 • • Reciprocating, oscillating, or vibrating part of 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 conductor

3/12 • • arranged in slots

3/14 • • • with transposed conductors, e.g. twisted conductor
3/16 • • • for damping, commutating, or other auxiliary purposes
3/18 • • Windings for salient poles
3/20 • • • for damping, commutating, or other auxiliary purposes
3/22 • • consisting of hollow conductors
3/24 • • with channels or ducts between the conductors for flow of cooling medium
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
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 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 • • • • where the devices are 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 • • affording protection from ingress, e.g. of water, of fingers
5/12 • • specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00)
5/124 • • • Sealing of the shaft **[3]**
5/128 • • • using air-gap sleeve or air-gap disc **[3]**
5/132 • • • Submersible electric motor (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 support, means for fitting the bearing in the bearing-shield (magnetic bearings H02K 7/09)
5/167 • • • using sliding-contact or spherical cap bearings **[3]**
5/173 • • • using ball bearings or bearings with rolling contact **[3]**
5/18 • • with ribs or fins for improving heat transfer
5/20 • • with channels or ducts for flow of cooling medium
5/22 • • Other additional parts of casings, e.g. shaped to form connection or terminal box
5/24 • specially adapted for suppression or reduction of noise or vibration
5/26 • Means for adjusting the casing relative to its support

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

7/02 • Additional mass for increasing inertia, e.g. flywheel
7/04 • Balancing means
7/06 • Means for converting reciprocating into rotary motion or vice versa
7/065 • • Electromechanical oscillators; Vibrating magnetic drives **[3]**
7/07 • • using pawl and ratchet wheel **[3]**
7/075 • • using crankshaft or eccentric **[3]**
7/08 • Structural association with bearings
7/09 • • with magnetic bearings **[3]**
7/10 • Structural association with clutches, brakes, gears, pulleys, 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 and brakes
7/114 • • with dynamo-electric clutches and brakes
7/116 • • with gears
7/118 • • with starting device
7/12 • • with auxiliary limited movement of stator, rotor, or core parts, e.g. rotor axially movable for the purpose of clutching or braking
7/14 • Structural association with mechanical load, 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 critical speed of vibration of 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 Systems 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 flow of cooling medium, e.g. having fan
9/06 • • • with fan or impeller 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 with 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, stator or rotor, e.g. heat bridge
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 with machine of devices for cleaning or drying cooling medium, e.g. of filter
9/28 • Cooling of commutators, slip-rings or brushes, e.g. by ventilating

11/00 Structural association with measuring or protective devices or electric components, e.g. with resistor, with switch, with suppressor for radio interference
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, 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 of slip-rings with the winding
13/04 • Connections of commutator segments with the winding
13/06 • • Resistive connections between winding and commutator segments, e.g. by high-resistance choke, by transistor
13/08 • • Segments formed by extensions of winding
13/10 • Special arrangements of brushes or commutators for the purpose of improving commutation
13/12 • Means for producing an axial reciprocation of the rotor and its associated current collector part, e.g. for polishing commutator surface
13/14 • Circuit arrangements for improvement of commutation, e.g. by use of unidirectionally conductive element

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

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 winding, e.g. capacitor motor
17/10 • • • Motors with auxiliary phase obtained by split-pole carrying short-circuited winding
17/12 • • for multi-phase current
17/14 • • • having windings arranged for permitting pole-changing
17/16 • • having rotor with internally short-circuited windings, e.g. cage rotor
17/18 • • • having double- or multiple-cage rotor
17/20 • • • having deep-bar rotor
17/22 • • having rotor with windings connected to slip-rings
17/24 • • • in which both stator and rotor are fed with ac
17/26 • • having rotor or stator designed to permit synchronous operation
17/28 • • having compensating winding for improving phase angle
17/30 • • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the motor, e.g. with impedances or switches
17/32 • • Structural association 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 machine

19/00 Synchronous motors or generators (having permanent magnet 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 motor
19/08 • • • Motors having windings on the stator and a smooth rotor of material with large hysteresis without windings, e.g. hysteresis motor
19/10 • • for multi-phase current

19/12 • • • characterised by the arrangement of exciting windings, e.g. for self-excitation, for compounding, for pole-changing
19/14 • • having additional short-circuited winding for starting as an asynchronous motor
19/16 • Synchronous generators
19/18 • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generator
19/20 • • • with variable-reluctance soft-iron rotor without winding
19/22 • • having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generator
19/24 • • • with variable-reluctance soft-iron rotor without winding
19/26 • • characterised by the arrangement of exciting winding
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 with auxiliary electric devices influencing the characteristic of, or controlling, the generator, e.g. with impedances or switches
19/38 • • Structural association with exciting machine

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

21/02 • Details
21/04 • • Windings on magnet for additional excitation
21/10 • • Rotating armatures
21/12 • with stationary armature and rotating magnet
21/14 • • magnet rotating within armature
21/16 • • • having an annular armature core with salient poles (with homopolar co-operation H02K 21/20)
21/18 • • • having horse-shoe armature core (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 • • magnet rotating around armature, e.g. flywheel magneto
21/24 • • magnet axially facing armature, e.g. hub-type cycle dynamo
21/26 • with rotating armature and stationary magnet
21/28 • • armature rotating within magnet
21/30 • • • having an annular armature core with salient poles (with homopolar co-operation H02K 21/36)
21/32 • • • having a horse-shoe magnet (with homopolar co-operation H02K 21/36)
21/34 • • • having bell-shaped or bar-shaped magnet, e.g. for cycle lighting (with homopolar co-operation H02K 21/36)
21/36 • • • with homopolar co-operation
21/38 • with rotating flux distributor, and armature and magnet both stationary
21/40 • • flux distributor rotating around magnet and within armature
21/42 • • flux distributor rotating around armature and within magnet
21/44 • • armature windings wound upon magnet
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 the exciting arrangement
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 a current source 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, by 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 machine, metadyne, amplidyne, other armature-reaction excited machine
23/22 • • having compensating or damping winding
23/24 • • having commutating-pole winding
23/26 • characterised by the armature winding
23/28 • • having open winding, i.e. not closed within armature
23/30 • • having lap winding; having loop winding
23/32 • • having wave winding; having undulating winding
23/34 • • having mixed windings
23/36 • • having more than one winding; having more than one commutator; having more than one stator
23/38 • • having winding or connection for improving commutation, e.g. equipotential connection
23/40 • characterised by the arrangement of the magnet circuit
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 or turnable iron parts
23/46 • • having stationary shunts, i.e. magnetic cross flux
23/48 • • having adjustable armature
23/50 • Generators with two or more outputs
23/52 • Motors acting also as generators, e.g. starting motor used as generator for ignition or lighting
23/54 • Disc armature motors or generators
23/56 • Motors or generators having the iron core separated from armature winding
23/58 • Motors or generators having no iron core
23/60 • Motors or generators having a rotating armature and a rotating excitation field
23/62 • Motors or generators with stationary armature 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, 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, 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, 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 a drum or disc armature 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 armature moved one way by energisation of a single coil system and returned by mechanical force, e.g. by spring
33/04 • • wherein the frequency of operation is determined by the frequency of uninterrupted ac energisation
33/06 • • • with polarised armature
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 armature
33/12 • with armature 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 armature
33/16 • with polarised armature moving in alternate directions by reversal or energisation of a single coil system
33/18 • with coil system moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnet

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 magnet and stationary coil system
35/04 • with moving coil system and stationary magnet
35/06 • with moving flux distributor, and both coil system and magnet 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 • variable reluctance type **[4]**
37/04 • • Rotor situated within stator **[4]**
37/06 • • Rotor situated around stator **[4]**
37/08 • • Rotor axially facing stator **[4]**
37/10 • permanent magnet type (H02K 37/02 takes precedence) **[4]**
37/12 • • with stationary armature and rotating magnet **[4]**
37/14 • • • Magnet rotating within armature **[4]**
37/16 • • • • having horseshoe armature core **[4]**
37/18 • • • • homopolar type **[4]**
37/20 • • with rotating flux distributor, the armature and magnet 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. 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 channel **[3]**
44/14 • • • Circular or screw-shaped channel **[3]**

44/16 • • Constructional details of the magnetic circuit **[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 machine 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]**

57/00 Dynamo-electric machines not provided for in groups H02K 17/00-H02K 55/00 [3]