

CPC**COOPERATIVE PATENT CLASSIFICATION****H02K**

DYNAMO-ELECTRIC MACHINES (measuring instruments [G01](#); dynamo-electric relays [H01H 53/00](#); conversion of dc or ac input power into surge output power [H03K 3/53](#); loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers [H04R](#))

NOTE

This subclass covers structural adaptation of the machine for the purposes of its control.

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](#).

H02K 1/00

Details of the magnetic circuit (magnetic circuits or magnets in general, magnetic circuits for transformers for power supply [H01F](#); magnetic circuits for relays [H01H 50/16](#))

H02K 1/02

- . characterised by the magnetic material

H02K 1/04

- . characterised by the material used for insulating the magnetic circuit or parts thereof (insulation of windings [H02K 3/30](#))

H02K 1/06

- . characterised by the shape, form, or construction

H02K 1/08

- .. Salient poles

H02K 1/10

- ... Commutating poles

H02K 1/12

- .. Stationary parts of the magnetic circuit

H02K 1/14

- ... Stator cores with salient poles

H02K 1/141

- {consisting of C-shaped cores}

H02K 1/143

- {of the horse-shoe type}

H02K 1/145

- {having an annular coil, e.g. of the claw-pole type}

H02K 1/146

- {consisting of a generally annular yoke with salient poles}

H02K 1/148

- {Sectional cores ([H02K 1/141](#) takes precedence)}

H02K 1/16

- ... Stator cores with slots for windings

H02K 1/165

- {Shape, form or location of the slots}

H02K 1/17

- ... Stator cores with permanent magnets

H02K 1/18

- ... Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures

H02K 1/182

- {to stators axially facing the rotor, i.e. with axial or conical air gap}

H02K 1/185

- {to outer stators}

H02K 1/187

- {to inner stators}

H02K 1/20

- ... with channels or ducts for flow of cooling medium

H02K 1/22

- .. Rotating parts of magnetic circuit

- H02K 1/223 ... { Rotor cores with windings and permanent magnets (for additional excitation in synchronous motors or generators [H02K 21/042](#); in synchronous motors having additional short-circuited winding for starting as an asynchronous motor [H02K 21/46](#))}
- H02K 1/226 {of the claw-pole type}
- H02K 1/24 ... Rotor cores with salient poles; { Variable reluctance rotors}
- H02K 1/243 {of the claw-pole type}
- H02K 1/246 { Variable reluctance rotors}
- H02K 1/26 ... Rotor cores with slots for windings
- H02K 1/265 {Shape, form or location of the slots}
- H02K 1/27 ... Rotor cores with permanent magnets {(rotor cores for synchronous machines with means for mechanical adjustment of the excitation flux [H02K 21/021](#))}
- H02K 1/2706 {Inner rotor}
- H02K 1/2713 {where the magnetisation axis of the magnets is axial}
- H02K 1/272 {where the magnetisation axis of the magnets is radial or tangential}
- H02K 1/2726 {consisting of a single magnet or of a plurality of axially juxtaposed single magnets}
- H02K 1/2733 {Annular magnets}
- H02K 1/274 { consisting of a plurality of circumferentially positioned magnets}
- H02K 1/2746 { consisting of magnets arranged with the same polarity}
- H02K 1/2753 { consisting of magnets or groups of magnets arranged with alternating polarity}
- H02K 1/276 { Magnets embedded in the magnetic core}
- H02K 1/2766 { having a flux concentration effect}
- H02K 1/2773 { consisting of tangentially magnetized radial magnets}
- H02K 1/278 { Surface mounted magnets; Inset magnets}
- H02K 1/2786 {Outer rotor}
- H02K 1/2793 {Rotor axially facing stator}
- H02K 1/28 ... Means for mounting or fastening rotating magnetic parts on to, or to, the rotor structures
- H02K 1/30 using intermediate part or parts, e.g. spider
- H02K 1/32 ... with channels or ducts for flow of cooling medium
- H02K 1/325 {between salient poles}
- H02K 1/34 .. Reciprocating, oscillating, or vibrating part of magnetic circuit

H02K 3/00 Details of windings (coils in general [H01F 5/00](#))

- H02K 3/02 . Windings characterised by the conductor material (conductors in general [H01B 1/00](#), [H01B 5/00](#))
- H02K 3/04 . Windings characterised by the conductor shape, form, or construction, e.g. with bar conductor
- H02K 3/12 .. arranged in slots

- H02K 3/14 . . . with transposed conductors, e.g. twisted conductor
- H02K 3/16 . . . for damping, commutating, or other auxiliary purposes
- H02K 3/18 . . Windings for salient poles
- H02K 3/20 . . . for damping, commutating, or other auxiliary purposes
- H02K 3/22 . . consisting of hollow conductors
- H02K 3/24 . . with channels or ducts between the conductors for flow of cooling medium
- H02K 3/26 . . consisting of printed conductors
- H02K 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](#))

- H02K 3/30 . Windings characterised by the insulating material ([insulating bodies in general H01B 3/00](#), [H01B 17/00](#))

- H02K 3/32 . Windings characterised by the shape, form, or construction of the insulation ([H02K 3/46 takes precedence](#))
- H02K 3/325 . . {for windings on salient poles, such as claw-shaped poles}
- H02K 3/34 . . between conductors or between conductor and core, e.g. slot insulation
- H02K 3/345 . . . {between conductor and core, e.g. slot insulation}
- H02K 3/38 . . around winding heads, equalising connectors, or connections thereto
- H02K 3/40 . . for high voltage, e.g. affording protection against corona

- H02K 3/42 . Means for preventing or reducing eddy-current losses in the winding heads, e.g. by shielding

- H02K 3/44 . Protection against moisture or chemical attack; Windings specially adapted for operation in liquid or gas

- H02K 3/46 . Fastening of windings on stator or rotor structure
- H02K 3/47 . . Air-gap windings, i.e. iron-free windings
- H02K 3/48 . . in slots
- H02K 3/487 . . . Slot-closing devices
- H02K 3/493 where the devices are magnetic
- H02K 3/50 . . Fastening of winding heads, equalising connectors, or connections thereto ([H02K 3/52 takes precedence](#))
- H02K 3/505 . . . {for large machine windings, e.g. bar windings ([H02K 3/51 takes precedence](#))}
- H02K 3/51 . . . applicable to rotors only
- H02K 3/52 . . Fastening salient pole windings or connections thereto
- H02K 3/521 . . . {applicable to stators only}
- H02K 3/522 {for generally annular cores with salient poles}
- H02K 3/524 {for U-shaped, E-shaped or similarly shaped cores}
- H02K 3/525 {Annular coils, e.g. for cores of the claw-pole type}
- H02K 3/527 . . . {applicable to rotors only}
- H02K 3/528 {of the claw-pole type}

H02K 5/00	Casings; Enclosures; Supports (casings for electric apparatus in general H05K 5/00)
H02K 5/02	. Casings or enclosures characterised by the material thereof
H02K 5/04	. Casings or enclosures characterised by the shape, form or construction thereof
H02K 5/06	.. Cast metal casings
H02K 5/08	.. Insulating casings
H02K 5/10	.. affording protection from ingress, e.g. of water, of fingers ({ means for protecting brushes or brush holders H02K 5/14 })
H02K 5/12	.. specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00)
H02K 5/124	... Sealing of the shaft
H02K 5/128	... using air-gap sleeve or air-gap disc
H02K 5/1282	.... {the partition wall in the air-gap being non cylindrical }
H02K 5/1285	.... {of the submersible type }
H02K 2005/1287	.... {Details of sleeves or discs }
H02K 5/132	... Submersible electric motor (H02K 5/128 takes precedence ; pumping installations or systems for submerged use F04D 13/08)
H02K 5/136	... explosion-proof
H02K 5/14	.. Means for supporting or protecting brushes or brush holders
H02K 5/141	... { for cooperation with slip-rings }
H02K 5/143	... { for cooperation with commutators }
H02K 5/145	.... {Fixedly supported brushes or brush holders, e.g. leaf or leaf-mounted brushes }
H02K 5/146	.... {Pivotally supported brushes or brush holders }
H02K 5/148	.... {Slidably supported brushes }
H02K 5/15	.. Mounting arrangements for bearing-shields or end plates
H02K 5/16	.. Means for supporting bearings, e.g. insulating support, means for fitting the bearing in the bearing-shield (magnetic bearings H02K 7/09)
H02K 5/161	... { radially supporting the rotary shaft at both ends of the rotor (H02K 5/165, H02K 5/167, H02K 5/173 take precedence) }
H02K 5/163	... { radially supporting the rotary shaft at only one end of the rotor (H02K 5/165, H02K 5/167, H02K 5/173 take precedence) }
H02K 5/165	... { radially supporting the rotor around a fixed spindle; radially supporting the rotor directly (H02K 5/167, H02K 5/173 take precedence) }
H02K 5/167	... using sliding-contact or spherical cap bearings
H02K 5/1672	.... {radially supporting the rotary shaft at both ends of the rotor (H02K 5/1677 takes precedence) }
H02K 5/1675	.... {radially supporting the rotary shaft at only one end of the rotor (H02K 5/1677 takes precedence) }
H02K 5/1677	.... {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly }
H02K 5/173	... using ball bearings or bearings with rolling contact

- H02K 5/1732 {radially supporting the rotary shaft at both ends of the rotor ([H02K 5/1737](#) takes precedence)}
- H02K 5/1735 {radially supporting the rotary shaft at only one end of the rotor ([H02K 5/1737](#) takes precedence)}
- H02K 5/1737 {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly}
- H02K 5/18 . . with ribs or fins for improving heat transfer
- H02K 5/20 . . with channels or ducts for flow of cooling medium
- H02K 5/22 . . Other additional parts of casings, e.g. shaped to form connection or terminal box
- H02K 5/225 . . . { Terminal boxes or connection arrangements (specially adapted for submersible motors [H02K 5/132](#))}
- H02K 5/24 . specially adapted for suppression or reduction of noise or vibration {(elastic means for supporting brush holders [H02K 5/14](#); elastic means for supporting bearings [H02K 5/16](#))}
- H02K 5/26 . Means for adjusting the casing relative to its support
- H02K 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**
- H02K 7/003 . {Couplings; Details of shafts (means for mounting rotors on shafts [H02K 1/28](#))}
- H02K 7/006 . {Structural association of a motor or generator with the drive train of a motor vehicle}
- H02K 7/02 . Additional mass for increasing inertia, e.g. fly-wheel
- H02K 7/025 . . {for power storage}
- H02K 7/04 . Balancing means
- H02K 7/06 . Means for converting reciprocating into rotary motion or vice-versa
- H02K 7/061 . . {using rotary unbalanced masses (for generating mechanical vibrations in general [B06B 1/16](#))}
- H02K 7/063 . . . {integrally combined with motor parts, e.g. motors with eccentric rotors}
- H02K 7/065 . . Electromechanical oscillators; Vibrating magnetic drives (in time-pieces [G04C 5/00](#))
- H02K 7/07 . . using pawl and ratchet wheel
- H02K 7/075 . . using crankshaft or eccentric
- H02K 7/08 . Structural association with bearings (support in machine casing [H02K 5/16](#))
- H02K 7/081 . . {specially adapted for worm gear drives ([H02K 7/09](#) takes precedence)}
- H02K 7/083 . . {radially supporting the rotary shaft at both ends of the rotor ([H02K 7/086](#), [H02K 7/09](#) take precedence)}
- H02K 7/085 . . {radially supporting the rotary shaft at only one end of the rotor ([H02K 7/086](#), [H02K 7/09](#) take precedence)}

- H02K 7/086 .. {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly ([H02K 7/09](#) takes precedence)}
- H02K 7/088 ... {radially supporting the rotor directly}
- H02K 7/09 .. with magnetic bearings

- H02K 7/10 . Structural association with clutches, brakes, gears, pulleys, mechanical starters

NOTE

Group [H02K 7/12](#) takes precedence over groups [H02K 7/102](#) to [H02K 7/118](#)

- H02K 7/1004 .. {with pulleys}
- H02K 7/1008 ... {structurally associated with the machine rotor ([H02K 7/1012](#) takes precedence)}
- H02K 7/1012 ... {Machine arranged inside the pulley}
- H02K 7/1016 {Machine of the outer rotor type}
- H02K 7/102 .. with friction brakes
- H02K 7/1021 ... {Magnetically influenced friction brakes}
- H02K 7/1023 {using electromagnets}
- H02K 7/1025 {using axial electromagnets with generally annular air gap}
- H02K 7/1026 {using stray fields}
- H02K 7/1028 {axially attracting the brake armature in the frontal area of the magnetic core}
- H02K 7/104 .. with eddy-current brakes
- H02K 7/106 .. with dynamo-electric brakes
- H02K 7/108 .. with friction clutches
- H02K 7/1085 ... {Magnetically influenced friction clutches}
- H02K 7/11 .. with dynamo-electric clutches
- H02K 7/112 .. with friction clutches and brakes
- H02K 7/1125 ... {Magnetically influenced friction clutches and brakes}
- H02K 7/114 .. with dynamo-electric clutches and brakes
- H02K 7/116 .. with gears
- H02K 7/1163 ... {where at least two gears have non-parallel axes without having orbital motion}
- H02K 7/1166 { comprising worm and worm-wheel (structural association with bearings specially adapted for worm gear drives [H02K 7/081](#))}
- H02K 7/118 .. with starting device
- H02K 7/1185 ... { with a mechanical one-way direction control, i.e. with means for reversing the direction of rotation of the rotor}
- H02K 7/12 .. with auxiliary limited movement of stator, rotor, or core parts, e.g. rotor axially movable for the purpose of clutching or braking
- H02K 7/125 ... {magnetically influenced}
- H02K 7/14 . Structural association with mechanical load, e.g. hand-held machine tool, fan ({[H02K 7/006](#) takes precedence;}with fan or impeller for cooling the machine [H02K 9/06](#); for suction cleaners [A47L](#))

- H02K 7/145 .. {Hand-held machine tool}
- H02K 7/16 .. for operation above critical speed of vibration of rotating parts
- H02K 7/18 . Structural association of electric generator with mechanical driving motor, e.g. turbine (if the driving-motor aspect predominates, see the relevant subclass of section F, e.g. [F03B 13/00](#))
- H02K 7/1807 .. {Rotary generators ([H02K 7/006](#) takes precedence)}
- H02K 7/1815 ... {structurally associated with reciprocating piston engines (general aspects of generating sets, e.g. housing, [F02B 63/04](#))}
- H02K 7/1823 ... {structurally associated with turbines or similar engines}
- H02K 7/183 { wherein the turbine is a wind turbine (adaptation of a wind turbine to an electric generator [F03D 9/002](#))}
- H02K 7/1838 { Generators mounted in a nacelle or similar structure of a horizontal axis wind turbine}
- H02K 7/1846 ... {structurally associated with wheels or associated parts (dynamoes arranged in the wheel hub of cycles [B62J 6/12](#))}
- H02K 7/1853 ... {driven by intermittent forces}
- H02K 7/1861 ... { driven by animals or vehicles ([H02K 7/1853](#) takes precedence)}
- H02K 7/1869 .. { Linear generators; sectional generators}
- H02K 7/1876 ... {with reciprocating, linearly oscillating or vibrating parts}
- H02K 7/1884 {structurally associated with free piston engines}
- H02K 7/1892 .. {Generators with parts oscillating or vibrating about an axis}
- H02K 7/20 . Structural association with auxiliary dynamo-electric machine, e.g. with electric starter motor, with exciter
- H02K 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](#))
- H02K 9/005 . { Details of cooling systems with unspecified cooling medium flowing through channels in or between the conductors}
- H02K 9/02 . by ambient air flowing through the machine
- H02K 9/04 .. having means for generating flow of cooling medium, e.g. having fan
- H02K 9/06 ... with fan or impeller driven by the machine shaft
- H02K 9/08 . by gaseous cooling medium circulating wholly within the machine casing ([H02K 9/10](#) takes precedence)
- H02K 9/10 . by gaseous cooling medium flowing in closed circuit, a part of which is external to the machine casing
- H02K 9/12 .. wherein the cooling medium circulates freely within the casing
- H02K 9/14 . wherein gaseous cooling medium circulates between the machine casing and a surrounding mantle

- H02K 9/16 . . wherein the cooling medium circulates through ducts or tubes within the casing
- H02K 9/18 . . wherein the external part of the closed circuit comprises a heat exchanger structurally associated with the machine casing
- H02K 9/19 . for machines with closed casing and with closed circuit cooling using a liquid cooling medium, e.g. oil
- H02K 9/193 . . with provision for replenishing the cooling medium; with means for preventing leakage of the cooling medium
- H02K 9/197 . . in which the rotor or stator space is fluid tight, e.g. to provide for different cooling media for rotor and stator
- H02K 9/20 . . wherein the cooling medium vaporises within the machine casing
- H02K 9/22 . by solid heat conducting material embedded in, or arranged in contact with, stator or rotor, e.g. heat bridge
- H02K 9/24 . Protection against failure of cooling arrangements, e.g. due to loss of cooling medium, due to interruption of the circulation of cooling medium ([circuit arrangements affording such protection H02H 7/00](#))
- H02K 9/26 . Structural association with machine of devices for cleaning or drying cooling medium, e.g. of filter
- H02K 9/28 . Cooling of commutators, slip-rings, or brushes, e.g. by ventilating, ([current collectors in general H01R 39/00](#))
- H02K 11/00** **Structural association with measuring or protective devices or electric components, e.g. with resistor, with switch, with suppressor for radio interference**
{(heating or drying of machines in operational state, e.g. standstill heating [H02K 15/125](#); structural association with auxiliary electric devices influencing the characteristic of, or controlling: asynchronous induction motors [H02K 17/30](#); synchronous generators without permanent magnets [H02K 19/36](#); dc commutator machines or universal ac/dc commutator motors [H02K 23/66](#); ac commutator machines [H02K 27/28](#))}
- H02K 11/0005 . { Electric or magnetic shielding arrangements, i.e. for shielding the electrical machine, the machine components or external devices against electric or magnetic fields generated inside or outside the machine ([H02K 11/02 takes precedence](#))}
- H02K 11/001 . { Structural association with devices for measuring, monitoring, protecting, switching}
- H02K 11/0015 . . { actuated by or sensing speed or position (specially adapted for machines having non-mechanical commutating devices [H02K 29/06](#), [H02K 29/14](#))}
- H02K 11/0021 . . . {using magnetic effect devices, e.g. Hall, magneto-resistive elements}
- H02K 11/0026 . . . {using optical devices}
- H02K 11/0031 . . . { using detecting coils; using the machine windings as detecting coil}
- H02K 11/0036 . . . {using mechanically actuated centrifugal switches}
- H02K 11/0042 . . { actuated by or sensing torque}
- H02K 11/0047 . . { actuated by or sensing temperature (overcurrent protection sensitive to other parameters than temperature [H02K 11/0057](#))}
- H02K 11/0052 . . { actuated by or sensing over-voltage, e.g. over-voltage protection}

H02K 11/0057	.. { actuated by or sensing overcurrent}
H02K 11/0063	.. { Manual switches}
H02K 11/0068	. { Structural association with control circuits, drive circuits}
H02K 11/0073	.. { Drive circuits, e.g. power electronics (H02K 11/0084 and H02K 11/048 take precedence)}
H02K 11/0078	.. { with devices for recording or transmitting machine parameters, e.g. memory chips for diagnostic; radio-transmitters}
H02K 11/0084	.. { associated with gear motors of the worm-and-wheel type}
H02K 11/0089	. { Structural association with grounding devices}
H02K 11/0094	. { Structural association with other electrical or electronic devices}
H02K 11/02	. for suppression of radio interference
H02K 11/022	.. {Details, e.g. shields}
H02K 11/024	... {Suppressors}
H02K 11/026	.... {associated with brushes, brush holders or their supports}
H02K 11/028	.... {associated with the rotor (H02K 13/105 takes precedence)}
H02K 11/04	. for rectification
H02K 11/042	.. {with rotating rectifiers}
H02K 11/044	.. {in motors (H02K 11/042 takes precedence)}
H02K 11/046	.. {in generators (H02K 11/042 takes precedence)}
H02K 11/048	... { Rectifiers combined with drive circuits in starter-generators}
H02K 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
H02K 13/003	. {Structural associations of slip-rings}
H02K 13/006	. {Structural associations of commutators}
H02K 13/02	. Connections of slip-rings with the winding
H02K 13/04	. Connections of commutator segments with the winding
H02K 13/06	.. Resistive connections between winding and commutator segments, e.g. by high-resistance choke, by transistor
H02K 13/08	.. Segments formed by extensions of winding
H02K 13/10	. Special arrangements of brushes or commutators for the purpose of improving commutation
H02K 13/105	.. {Spark suppressors associated with the commutator}

- H02K 13/12 . Means for producing an axial reciprocation of the rotor and its associated current collector part, e.g. for polishing commutator surface
- H02K 13/14 . Circuit arrangements for improvement of commutation, e.g. by use of unidirectionally conductive element
- H02K 15/00** **Methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing dynamo-electric machines** (manufacture of current collectors in general [H01R 43/00](#))
- H02K 15/0006 . { Disassembling, repairing or modifying dynamo-electric machines (repairing of cooling fluid boxes [H02K 15/0093](#))}
- H02K 15/0012 . {Manufacturing cage rotors}
- H02K 15/0018 . {Applying slot closure means in the core; Manufacture of slot closure means}
- H02K 15/0025 . { Shaping or compacting conductors or winding heads after the installation of the winding in the core or machine (methods or apparatus for simultaneously twisting a plurality of hairpins prior to mounting [H02K 15/0428](#)); Applying fastening means on winding heads}
- H02K 15/0031 . . { Shaping or compacting conductors in slots or around salient poles ([H02K 15/005](#) takes precedence)}
- H02K 15/0037 . . { Shaping or compacting winding heads ([H02K 15/005](#), [H02K 15/0087](#) and [H02K 15/0428](#) take precedence)}
- H02K 15/0043 . . . { Applying fastening means on winding headS (fastening by applying resin, glue, varnish and similar means [H02K 15/12](#))}
- H02K 15/005 . . { by means of electrodynamic forces}
- H02K 15/0056 . { Manufacturing winding connections (manufacturing connectors in general [H01R 43/00](#))}
- H02K 15/0062 . . { Manufacturing the terminal arrangement per se; Connecting the terminals to an external circuit}
- H02K 15/0068 . . { Connecting winding sections; Forming leads; Connecting leads to terminals}
- H02K 15/0075 . . . { for random-wound windings}

NOTE

Windings consisting of cables are classified in [H02K 15/0068](#)

- H02K 15/0081 . . . { for form-wound windings}
- H02K 15/0087 { characterised by the method or apparatus for simultaneously twisting a plurality of hairpins open ends after insertion into the machine (for simultaneously twisting a plurality of hairpins prior to mounting into the machine [H02K 15/0428](#))}
- H02K 15/0093 { Manufacturing or repairing cooling fluid boxes, i.e. terminals of fluid cooled windings ensuring both electrical and fluid connection} [

- H02K 15/02 . of stator or rotor bodies
- H02K 15/022 .. {with salient poles or claw-shaped poles}
- H02K 15/024 .. {with slots}
- H02K 15/026 ... { Wound cores}
- H02K 15/028 ... {for fastening to casing or support, respectively to shaft or hub}
- H02K 15/03 .. having permanent magnets

- H02K 15/04 . of windings, prior to mounting into the machine ([insulating windings H02K 15/10](#), [H02K 15/12](#); [coil manufacture in general H01F 41/02](#))
- H02K 15/0407 .. { Windings manufactured by etching, printing or stamping the complete coil}
- H02K 15/0414 .. { Windings consisting of separate elements, e.g. bars, hairpins, segments, half coils}
- H02K 15/0421 ... { consisting of single conductors, e.g. hairpins}
- H02K 15/0428 { characterised by the method or apparatus for simultaneously twisting a plurality of hairpins ([for simultaneously twisting a plurality of hairpins open ends after insertion into the machine H02K 15/0087](#))}

- H02K 15/0435 .. { Wound windings}
- H02K 15/0442 ... { Loop windings ([manufacturing of windings consisting of overlapped loops H02K 15/0464](#))}
- H02K 15/045 {Form wound coils}
- H02K 15/0457 { Random wound coils}
- H02K 15/0464 ... { Lap windings ([when on diagonally wound hollow coils H02K 15/0492](#))}
- H02K 15/0471 { manufactured by flattening a spiral winding}
- H02K 15/0478 ... { Wave windings, undulated windings ([when on diagonally wound hollow coils H02K 15/0492](#))}
- H02K 15/0485 { manufactured by shaping an annular winding}
- H02K 15/0492 ... { Diagonally wound hollow coils}

- H02K 15/06 . Embedding prefabricated windings in the machine
- H02K 15/061 .. { Air-gap windings}
- H02K 15/062 .. { Windings in slots; salient pole windings}
- H02K 15/063 ... { Windings for large electric machines, e.g. bar windings ([windings consisting of cables H02K 15/065](#))}
- H02K 15/064 ... { Windings consisting of separate segments, e.g. hairpin windings ([H02K 15/063 takes precedence](#))}
- H02K 15/065 ... { Windings consisting of complete sections, e.g. coils, waves ([windings for large electric machines other than those consisting of cables H02K 15/063](#))}
- H02K 15/066 { inserted perpendicularly to the axis of the slots or inter-polar channels}
- H02K 15/067 { inserted in parallel to the axis of the slots or inter-polar channels}
- H02K 15/068 { Strippers}

- H02K 15/08 . Forming windings by laying conductors into or around core part
- H02K 15/085 .. by laying conductors into slotted stators

- H02K 15/09 . . . by laying conductors into slotted rotors
- H02K 15/095 . . . by laying conductors around salient poles
- H02K 15/10 . Applying solid insulation to the windings, the stator, or the rotor
- H02K 15/105 . . {to the windings}
- H02K 15/12 . Impregnating, heating or drying of windings, stators, rotors, or machines
- H02K 15/125 . . {Heating or drying of machines in operational state, e.g. standstill heating}
- H02K 15/14 . Casings; Enclosures; Supports
- H02K 15/16 . Centering the rotor within the stator; Balancing the rotor (balancing in general [G01M](#))
- H02K 15/165 . . {Balancing the rotor}

H02K 16/00 **Machines with more than one rotor or stator** {(machines for transmitting mechanical power from a driving shaft to a driven shaft and comprising structurally interrelated motor and generator parts [H02K 51/00](#); permanent magnet machines with multiple rotors or stators relatively rotated for vectorially combining the excitation fields or the armature voltages [H02K 21/029](#))}

- H02K 16/005 . {Machines with only rotors, e.g. counter-rotating rotors (DC commutator machines or universal AC/DC commutator motors having a rotating armature and a rotating excitation field [H02K 23/60](#))}
- H02K 16/02 . Machines with one stator and two {or more} rotors
- H02K 16/025 . . { with rotors and moving stators connected in a cascade (cascade arrangement of an asynchronous motor with another dynamo-electric motor or converter [H02K 17/34](#))}
- H02K 16/04 . Machines with one rotor and stators

NOTE

Group 16/00 takes precedence over groups [H02K 17/00](#) to [H02K 53/00](#).

H02K 17/00 **Asynchronous induction motors; Asynchronous induction generators**

- H02K 17/02 . Asynchronous induction motors
- H02K 17/04 . . for single phase current
- H02K 17/06 . . . having windings arranged for permitting pole-changing
- H02K 17/08 . . . Motors with auxiliary phase obtained by externally fed auxiliary winding, e.g. capacitor motor
- H02K 17/10 . . . Motors with auxiliary phase obtained by split-pole carrying short-circuited winding
- H02K 17/12 . . for multi-phase current
- H02K 17/14 . . . having windings arranged for permitting pole-changing

- H02K 17/16 . . . having rotor with internally short-circuited windings, e.g. cage rotor
- H02K 17/165 . . . {characterised by the squirrel-cage or other short-circuited windings}
- H02K 17/18 . . . having double or multiple-cage rotor
- H02K 17/185 {characterised by the double- or multiple cage windings}
- H02K 17/20 . . . having deep-bar rotor
- H02K 17/205 {characterised by the deep-bar windings}
- H02K 17/22 . . . having rotor with windings connected to slip-rings
- H02K 17/24 . . . in which both stator and rotor are fed with ac
- H02K 17/26 . . . having rotor or stator designed to permit synchronous operation
- H02K 17/28 . . . having compensating winding for improving phase angle
- H02K 17/30 . . . Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the motor, e.g. with impedance, with switch ([control arrangements external to the motor H02P](#))
- H02K 17/32 . . . Structural association with auxiliary mechanical devices, e.g. clutch, brake ([control arrangements external to the motor H02P](#))
- H02K 17/34 . . . Cascade arrangement of an asynchronous motor with another dynamo-electric motor or converter ({[machines with rotors and moving stators connected in a cascade H02K 16/025](#);} [control of cascade-arrangements H02P](#))
- H02K 17/36 . . . with another asynchronous induction motor
- H02K 17/38 . . . with a commutator machine
- H02K 17/40 . . . with a rotary ac/dc converter ([cascade ac/dc converters H02K 47/06](#))
- H02K 17/42 . . . Asynchronous induction generators ([H02K 17/02 takes precedence](#))
- H02K 17/44 . . . Structural association with exciting machine
- H02K 19/00 Synchronous motors or generators ([having permanent magnet H02K 21/00](#))**
- H02K 19/02 . . . Synchronous motors
- H02K 19/04 . . . for single-phase current
- H02K 19/06 . . . Motors having windings on the stator and a variable-reluctance soft-iron rotor without windings, e.g. inductor motor
- H02K 19/08 . . . Motors having windings on the stator and a smooth rotor of material with large hysteresis without windings, e.g. hysteresis motor
- H02K 19/10 . . . for multi-phase current
- H02K 19/103 . . . {Motors having windings on the stator and a variable reluctance soft-iron rotor without windings}
- H02K 19/106 . . . {Motors having windings in the stator and a smooth rotor of material with large hysteresis without windings}
- H02K 19/12 . . . characterised by the arrangement of exciting windings, e.g. for self-excitation, for compounding, for pole-changing
- H02K 19/14 . . . having additional short-circuited winding for starting as an asynchronous motor
- H02K 19/16 . . . Synchronous generators

- H02K 19/18 .. having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generator
- H02K 19/20 ... with variable-reluctance soft-iron rotor without winding
- H02K 19/22 .. having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generator
- H02K 19/24 ... with variable-reluctance soft-iron rotor without winding
- H02K 19/26 .. characterised by the arrangement of exciting winding
- H02K 19/28 ... for self-excitation
- H02K 19/30 ... for compounding
- H02K 19/32 ... for pole-changing
- H02K 19/34 .. Generators with two or more outputs
- H02K 19/36 .. Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the generator, e.g. with impedance, with switch ([control arrangements external to the generator H02P](#))
- H02K 19/365 ... { with a voltage regulator }
- H02K 19/38 .. Structural association with exciting machine

H02K 21/00 Synchronous motors having permanent magnet; Synchronous generators having permanent magnet ([stator cores with permanent magnets H02K 1/17](#); [rotor cores with permanent magnets H02K 1/27](#))

- H02K 21/02 . Details
- H02K 21/021 .. { Means for mechanical adjustment of the excitation flux }
- H02K 21/022 ... { by modifying the relative position between field and armature, e.g. between rotor and stator ([vectorial combination of field or armature sections H02K 21/029](#)) }
- H02K 21/023 { by varying the amount of superposition, i.e. the overlap, of field and armature }
- H02K 21/024 { Radial air gap machines }
- H02K 21/025 { by varying the thickness of the air gap between field and armature }
- H02K 21/026 { Axial air gap machines }
- H02K 21/027 { Conical air gap machines }
- H02K 21/028 ... { by modifying the magnetic circuit within the field or the armature, e.g. by using shunts, by adjusting the magnets position, by vectorial combination of field or armature sections }
- H02K 21/029 { Vectorial combination of the fluxes generated by a plurality of field sections or of the voltages induced in a plurality of armature sections }
- H02K 21/04 .. Windings on magnet for additional excitation { ; windings and magnets for additional excitation }
- H02K 21/042 ... { with permanent magnets and field winding both rotating }
- H02K 21/044 { Rotor of the claw pole type }
- H02K 21/046 ... { with rotating permanent magnets and stationary field winding }
- H02K 21/048 { Rotor of the claw pole type }
- H02K 21/10 .. Rotating armatures

- H02K 21/12 . with stationary armature and rotating magnet
- H02K 21/125 .. {having an annular armature coil ([H02K 21/14](#) to [H02K 21/24](#) take precedence)}
- H02K 21/14 .. magnet rotating within armature
- H02K 21/145 ... {having an annular armature coil (with homopolar co-operation [H02K 21/20](#))}
- H02K 21/16 ... having an annular armature core with salient poles (with homopolar co-operation [H02K 21/20](#))
- H02K 21/18 ... having horse-shoe armature core (with homopolar co-operation [H02K 21/20](#))
- H02K 21/185 {with the axis of the rotor perpendicular to the plane of the armature}
- H02K 21/20 ... having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine
- H02K 21/22 .. magnet rotating around armature, e.g. flywheel magneto
- H02K 21/222 ... {Flywheel magnetos}
- H02K 21/225 {having I-shaped, E-shaped or similarly shaped armature cores}
- H02K 21/227 ... {having an annular armature coil}
- H02K 21/24 .. magnet axially facing armature, e.g. hub-type cycle dynamo
- H02K 21/26 . with rotating armature and stationary magnet
- H02K 21/28 .. armature rotating within magnet
- H02K 21/30 ... having an annular armature core with salient poles (with homopolar co-operation [H02K 21/36](#))
- H02K 21/32 ... having a horse-shoe magnet (with homopolar co-operation [H02K 21/36](#))
- H02K 21/325 {with the axis of the rotating armature perpendicular to the plane of the magnet}
- H02K 21/34 ... having bell-shaped or bar-shaped magnet, e.g. for cycle lighting (with homopolar co-operation [H02K 21/36](#))
- H02K 21/36 ... with homopolar co-operation
- H02K 21/38 . with rotating flux distributor, and armature and magnet both stationary
- H02K 21/40 .. flux distributor rotating around magnet and within armature
- H02K 21/42 .. flux distributor rotating around armature and within magnet
- H02K 21/44 .. armature windings wound upon magnet
- H02K 21/46 . Motors having additional short-circuited winding for starting as an asynchronous motor
- H02K 21/48 . Generators with two or more outputs
- H02K 23/00 Dc commutator motors or generators having mechanical commutator; Universal ac/dc commutator motors**
- H02K 23/02 . characterised by the exciting arrangement
- H02K 23/023 .. {having short-circuited brushes}
- H02K 23/026 .. {having an unregular distribution of the exciting winding or of the excitation over the poles}

H02K 23/04	.. having permanent magnet excitation
H02K 23/06	.. having shunt connection of excitation windings
H02K 23/08	.. having series connection of excitation windings
H02K 23/10	.. having compound connection of excitation windings
H02K 23/12	.. having excitation produced by a current source independent of the armature circuit
H02K 23/14	.. having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field
H02K 23/16	.. having angularly adjustable excitation field, e.g. by pole reversing, by pole switching
H02K 23/18	.. having displaceable main or auxiliary brushes
H02K 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
H02K 23/22	.. having compensating or damping winding
H02K 23/24	.. having commutating-pole winding
H02K 23/26	. characterised by the armature winding
H02K 23/28	.. having open winding, i.e. not closed within armature
H02K 23/30	.. having lap winding; having loop winding
H02K 23/32	.. having wave winding; having undulating winding
H02K 23/34	.. having mixed windings
H02K 23/36	.. having more than one winding; having more than one commutator; having more than one stator
H02K 23/38	.. having winding or connection for improving commutation, e.g. equipotential connection
H02K 23/40	. characterised by the arrangement of the magnet circuit
H02K 23/405	.. {Machines with a special form of the pole shoes}
H02K 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
H02K 23/44	.. having movable or turnable iron parts
H02K 23/46	.. having stationary shunts, i.e. magnetic cross flux
H02K 23/48	.. having adjustable armature
H02K 23/50	. Generators with two or more outputs
H02K 23/52	. Motors acting also as generators, e.g. starting motor used as generator for ignition or lighting
H02K 23/54	. Disc armature motors or generators
H02K 23/56	. Motors or generators having the iron core separated from armature winding
H02K 23/58	. Motors or generators having no iron core

- H02K 23/60 . Motors or generators having a rotating armature and a rotating excitation field
{(machines with only rotors in general [H02K 16/005](#))}
- H02K 23/62 . Motors or generators with stationary armature and rotating excitation field
- H02K 23/64 . Motors specially adapted for running on dc or ac by choice
- H02K 23/66 . Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine, e.g. with impedance, with switch (control arrangements external to the machine [H02P](#))
- H02K 23/68 . Structural association with auxiliary mechanical devices, e.g. with clutch, with brake (control arrangements external to the machine [H02P](#))
- H02K 24/00** **Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn**
- H02K 25/00** **Dc interrupter motors or generators**
- H02K 26/00** **Machines adapted to function as torque motors, i.e. to exert a torque when stalled**
- H02K 27/00** **Ac commutator motors or generators having mechanical commutator (universal ac/dc motors {[H02K 23/00](#)}, [H02K 23/64](#))**
- H02K 27/02 . characterised by the armature winding
- H02K 27/04 . having single-phase operation in series or shunt connection
- H02K 27/06 . . with a single or multiple short-circuited commutator, e.g. repulsion motor
- H02K 27/08 . . with multiple-fed armature
- H02K 27/10 . . with switching devices for different modes of operation, e.g. repulsion-induction motor
- H02K 27/12 . having multi-phase operation
- H02K 27/14 . . in series connection
- H02K 27/16 . . in shunt connection with stator feeding
- H02K 27/18 . . in shunt connection with rotor feeding
- H02K 27/20 . Structural association with a speed regulating device
- H02K 27/22 . having means for improving commutation, e.g. auxiliary fields, double windings, double brushes
- H02K 27/24 . having two or more commutators
- H02K 27/26 . having disc armature

- H02K 27/28
 - . Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine ([control arrangements external to the machine H02P](#))
- H02K 27/30
 - . Structural association with auxiliary mechanical devices, e.g. clutch, brake ([control arrangements external to the machine H02P](#))
- H02K 29/00**
Motors or generators having non-mechanical commutating devices, e.g. discharge tubes, semiconductor devices
- H02K 29/03
 - . with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems
- H02K 29/06
 - . with position sensing devices
- H02K 29/08
 - . . using magnetic effect devices, e.g. Hall-plates, magneto-resistors ([H02K 29/12 takes precedence](#))
- H02K 29/10
 - . . using light effect devices
- H02K 29/12
 - . . using detecting coils { [using the machine windings as detecting coil](#)}
- H02K 29/14
 - . with speed sensing devices ({ [structural association with other mechanical energy devices H02K 7/00](#)})
- H02K 31/00**
Acyclic motors or generators, i.e. dc machines having a drum or disc armature with continuous current collectors
- H02K 31/02
 - . with solid-contact collectors
- H02K 31/04
 - . with at least one liquid-contact collector
- H02K 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](#))
- H02K 33/02
 - . with armature moved one way by energisation of a single coil system and returned by mechanical force, e.g. by spring
- H02K 33/04
 - . . wherein the frequency of operation is determined by the frequency of uninterrupted ac energisation
- H02K 33/06
 - . . . with polarised armature
- H02K 33/08
 - . . . with dc energisation superimposed on ac energisation
- H02K 33/10
 - . . wherein the alternate energisation and de-energisation of the single coil system is effected or controlled by movement of the armature
- H02K 33/12
 - . with armature moving in alternate directions by alternate energisation of two coil systems
- H02K 33/14
 - . . wherein the alternate energisation and de-energisation of the two coil systems are effected or controlled by movement of the armature

- H02K 33/16
 - . with polarised armature moving in alternate directions by reversal or energisation of a single coil system
- H02K 33/18
 - . with coil system moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnet
- H02K 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](#))
- H02K 35/02
 - . with moving magnet and stationary coil system
- H02K 35/04
 - . with moving coil system and stationary magnet
- H02K 35/06
 - . with moving flux distributor, and both coil system and magnet stationary
- H02K 37/00**

Motors with rotor rotating step by step and without interrupter or commutator driven by the rotor, e.g. stepping motors
- H02K 37/02
 - . variable reluctance type
- H02K 37/04
 - .. Rotor situated within stator
- H02K 37/06
 - .. Rotor situated around stator
- H02K 37/08
 - .. Rotor axially facing stator
- H02K 37/10
 - . permanent magnet type
- H02K 37/12
 - .. with stationary armature and rotating magnet
- H02K 37/125
 - ... {Magnet axially facing armature}
- H02K 37/14
 - ... Magnet rotating within armature
- H02K 37/16
 - having horse-shoe armature core
- H02K 37/18
 - homopolar type
- H02K 37/20
 - .. with rotating flux distributor, the armature and magnet both being stationary
- H02K 37/22
 - . Damping units
- H02K 37/24
 - . Structural association with auxiliary mechanical devices
- H02K 39/00**

Generators specially adapted for producing a desired non-sinusoidal waveform
- H02K 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 {(electromagnetic launchers [F41B 6/00](#))}
- H02K 41/02
 - . Linear motors; Sectional motors
- H02K 41/025
 - .. Asynchronous motors

- H02K 41/03 .. Synchronous motors; Motors moving step by step; Reluctance motors
([H02K 41/035 takes precedence](#))
- H02K 41/031 ... { of the permanent magnet type}
- H02K 41/033 { with armature and magnets on one member, the other member being a flux distributor}
- H02K 41/035 .. Dc motors; Unipolar motors
- H02K 41/0352 ... {Unipolar motors}
- H02K 41/0354 {Lorentz force motors, e.g. voice coil motors}
- H02K 41/0356 {moving along a straight path}
- H02K 41/0358 {moving along a curvilinear path}
- H02K 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; { Nutating motors, i.e. having the rotor axis inclined with respect to the stator axis and performing a nutational movement as the rotor rolls on the stator}
- H02K 41/065 .. { Nutating motors}
- H02K 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**
- H02K 44/02 . Electrodynamic pumps
- H02K 44/04 .. Conduction pumps
- H02K 44/06 .. Induction pumps
- H02K 44/08 . Magnetohydrodynamic (MHD) generators
- H02K 44/085 .. {with conducting liquids}
- H02K 44/10 .. Constructional details of electrodes
- H02K 44/12 .. Constructional details of fluid channel
- H02K 44/14 ... Circular or screw-shaped channel
- H02K 44/16 .. Constructional details of the magnetic circuit
- H02K 44/18 .. for generating ac power
- H02K 44/20 ... by changing the polarity of the magnetic field
- H02K 44/22 ... by changing the conductivity of the fluid
- H02K 44/24 ... by reversing the direction of fluid
- H02K 44/26 ... by creating a travelling magnetic field
- H02K 44/28 . Association of MHD generators with conventional generators ([nuclear power plants including a MHD generator G21D 7/02](#))
- H02K 47/00** **Dynamo-electric converters**
- H02K 47/02 . Ac/dc converters of vica versa

- H02K 47/04 . . Motor/generators
- H02K 47/06 . . Cascade converters
- H02K 47/08 . . Single-armature converters
- H02K 47/10 . . . with booster machine on the ac side

- H02K 47/12 . Dc/dc converters
- H02K 47/14 . . Motor/generators
- H02K 47/16 . . Single-armature converters, e.g. metadyne

- H02K 47/18 . Ac/ac converters
- H02K 47/20 . . Motor/generators
- H02K 47/22 . . Single-armature frequency converters with or without phase-number conversion
- H02K 47/24 . . . having windings for different numbers of poles
- H02K 47/26 . . . operating as under- or over-synchronously running asynchronous induction machines, e.g. cascade arrangement of asynchronous and synchronous machines
- H02K 47/28 . . . operating as commutator machines with added slip-rings
- H02K 47/30 . . Single-armature phase-number converters without frequency conversion

- H02K 49/00** **Dynamo-electric clutches; Dynamo-electric brakes** ([electrically or magnetically actuated clutches or brakes F16D 27/00, F16D 29/00, F16D 65/28](#); [magnetic-particle clutches F16D 37/02](#); adapted for use as dynamometers [G01L](#))

- H02K 49/02 . of the asynchronous induction type
- H02K 49/04 . . of the eddy-current hysteresis type [{\(eddy current brakes cooperating with a rail B61H 7/083\)}](#)
- H02K 49/043 . . . { with a radial airgap}
- H02K 49/046 . . . { with an axial airgap}

- H02K 49/06 . of the synchronous type [{\(H02K 49/10 takes precedence\)}](#)
- H02K 49/065 . . {hysteresis type}

- H02K 49/08 . of the collector armature type

- H02K 49/10 . of the permanent-magnet type
- H02K 49/102 . . { Magnetic gearings, i.e. assembly of gears, linear or rotary, by which motion is magnetically transferred without physical contact [\(magnetized gearings with physical contact F16H 13/12, F16H 49/005\)](#)}
- H02K 49/104 . . { Magnetic couplings consisting of only two coaxial rotary elements, i.e. the driving element and the driven element}
- H02K 49/106 . . . { with a radial air gap}
- H02K 49/108 . . . { with an axial air gap}

- H02K 49/12 . of the acyclic type

H02K 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
H02K 53/00	Alleged dynamo-electric perpetua mobilia
H02K 55/00	Dynamo-electric machines having windings operating at cryogenic temperatures
H02K 55/02	. of the synchronous type
H02K 55/04	. . with rotating field windings
H02K 55/06	. of the homopolar type
H02K 57/00	Dynamo-electric machines not provided for in groups H02K 17/00 to H02K 55/00
H02K 57/003	. {generators}
H02K 57/006	. {motors}
H02K 2201/00	Specific aspects not provided for in the other groups of this subclass relating to the magnetic circuits
H02K 2201/03	. Machines characterised by aspects of the air-gap between rotor and stator
H02K 2201/06	. Magnetic cores, or permanent magnets characterised by their skew
H02K 2201/09	. Magnetic cores comprising laminations characterised by being fastened by caulking
H02K 2201/12	. Transversal flux machines
H02K 2201/15	. Sectional machines
H02K 2201/18	. Machines moving with multiple degrees of freedom
H02K 2203/00	Specific aspects not provided for in the other groups of this subclass relating to the windings
H02K 2203/03	. Machines characterised by the wiring boards, i.e. printed circuit boards or similar structures for connecting the winding terminations
H02K 2203/06	. Machines characterised by the wiring leads, i.e. conducting wires for connecting the winding terminations
H02K 2203/09	. Machines characterised by wiring elements other than wires, e.g. bus rings, for connecting the winding terminations

H02K 2203/12	. Machines characterised by the bobbins for supporting the windings
H02K 2203/15	. Machines characterised by cable windings, e.g high-voltage cables, ribbon cables
H02K 2205/00	Specific aspects not provided for in the other groups of this subclass relating to casings, enclosures, supports
H02K 2205/03	. Machines characterised by thrust bearings
H02K 2205/06	. Machines characterised by means for keeping the brushes in a retracted position during assembly
H02K 2205/09	. Machines characterised by drain passages or by venting, breathing or pressure compensating means
H02K 2205/12	. Machines characterised by means for reducing windage losses or windage noise
H02K 2207/00	Specific aspects not provided for in the other groups of this subclass relating to arrangements for handling mechanical energy
H02K 2207/03	. Tubular motors, i.e. rotary motors mounted inside a tube, e.g. for blinds
H02K 2209/00	Specific aspects not provided for in the other groups of this subclass relating to systems for cooling or ventilating
H02K 2211/00	Specific aspects not provided for in the other groups of this subclass relating to measuring or protective devices or electric components
H02K 2211/03	. Machines characterised by circuit boards, e.g. pcb
H02K 2213/00	Specific aspects, not otherwise provided for and not covered by codes H02K 2201/00 - H02K 2211/00
H02K 2213/03	. Machines characterised by numerical values, ranges, mathematical expressions or similar information
H02K 2213/06	. Machines characterised by the presence of fail safe, back up, redundant or other similar emergency arrangements
H02K 2213/09	. Machines characterised by the presence of elements which are subject to variation, e.g. adjustable bearings, reconfigurable windings, variable pitch ventilators
H02K 2213/12	. Machines characterised by the modularity of some components