

# CPC COOPERATIVE PATENT CLASSIFICATION

## H ELECTRICITY

(NOTE omitted)

## 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 {[H03K 3/53](#)})

### NOTES

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 "microstructural devices" and "microstructural systems".
4. Group [H02K 16/00](#) takes precedence over groups [H02K 17/00](#) - [H02K 53/00](#).  
{This Note corresponds to IPC Note (1) relating to [H02K 17/00](#) - [H02K 53/00](#).}
5. {In this subclass, it is desirable to add the indexing codes of [H02K 2201/00](#)-[H02K 2213/12](#).}

### WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

<b>1/00</b>	<b>Details of the magnetic circuit (magnetic circuits for relays <a href="#">H01H 50/16</a>)</b>	1/223	. . .	{Rotor cores with windings and permanent magnets (for additional excitation in synchronous motors or generators <a href="#">H02K 21/042</a> ; in synchronous motors having additional short-circuited winding for starting as an asynchronous motor <a href="#">H02K 21/46</a> )}
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	1/24	. . .	Rotor cores with salient poles {; Variable reluctance rotors}
1/10	. . . Commutating poles			
1/12	. . Stationary parts of the magnetic circuit	1/243	. . . .	{of the claw-pole type}
1/14	. . . Stator cores with salient poles	1/246	. . . .	{Variable reluctance rotors}
1/141	. . . . {consisting of C-shaped cores}	1/26	. . .	Rotor cores with slots for windings
1/143	. . . . . {of the horse-shoe type}	1/265	. . . .	{Shape, form or location of the slots}
1/145	. . . . . {having an annular coil, e.g. of the claw-pole type}	1/27	. . .	Rotor cores with permanent magnets
1/146	. . . . . {consisting of a generally annular yoke with salient poles}	1/2706	. . . .	Inner rotors
1/148	. . . . . {Sectional cores ( <a href="#">H02K 1/141</a> takes precedence)}	1/2713	. . . . .	the magnetisation axis of the magnets being axial, e.g. claw-pole type
1/16	. . . Stator cores with slots for windings	1/272	. . . . .	the magnetisation axis of the magnets being perpendicular to the rotor axis
1/165	. . . . {Shape, form or location of the slots}	1/2726	. . . . .	the rotor consisting of a single magnet or two or more axially juxtaposed single magnets
1/17	. . . Stator cores with permanent magnets	1/2733	. . . . .	Annular magnets
1/18	. . . Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures	1/274	. . . . .	the rotor consisting of two or more circumferentially positioned magnets
1/182	. . . . {to stators axially facing the rotor, i.e. with axial or conical air gap}	1/2746	. . . . .	the rotor consisting of magnets arranged with the same polarity, e.g. consequent pole type
1/185	. . . . {to outer stators}			
1/187	. . . . {to inner stators}			
1/20	. . . with channels or ducts for flow of cooling medium	1/2753	. . . . .	the rotor consisting of magnets or groups of magnets arranged with alternating polarity
1/22	. . Rotating parts of the magnetic circuit	1/276	. . . . .	Magnets embedded in the magnetic core, e.g. interior permanent magnets [IPM]
		1/2766	. . . . .	{having a flux concentration effect}

- 1/2773 . . . . . {consisting of tangentially magnetized radial magnets}
- 1/278 . . . . . Surface mounted magnets; Inset magnets
- 1/2781 . . . . . Magnets shaped to vary the mechanical air gap between the magnets and the stator
- 1/2783 . . . . . with magnets arranged in Halbach arrays
- 1/2786 . . . . . Outer rotors
- 1/2787 . . . . . the magnetisation axis of the magnets being perpendicular to the rotor axis
- 1/2788 . . . . . the rotor consisting of a single magnet or two or more axially juxtaposed single magnets
- 1/2789 . . . . . the rotor consisting of two or more circumferentially positioned magnets
- 1/279 . . . . . Magnets embedded in the magnetic core
- 1/2791 . . . . . Surface mounted magnets; Inset magnets
- 1/27915 . . . . . Magnets shaped to vary the mechanical air gap between the magnets and the stator
- 1/2792 . . . . . with magnets arranged in Halbach arrays
- 1/2793 . . . . . Rotors axially facing stators
- 1/2795 . . . . . the rotor consisting of two or more circumferentially positioned magnets
- 1/2796 . . . . . where both axial sides of the rotor face a stator
- 1/2798 . . . . . where both axial sides of the stator face a rotor
- 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
- 1/325 . . . . . {between salient poles}
- 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
- 3/325 . . . {for windings on salient poles, such as claw-shaped poles}
- 3/34 . . . between conductors or between conductor and core, e.g. slot insulation
- 3/345 . . . {between conductor and core, e.g. slot insulation}
- 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
- 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
- 3/48 . . . in slots
- 3/487 . . . . Slot-closing devices
- 3/493 . . . . . magnetic
- 3/50 . . . Fastening of winding heads, equalising connectors, or connections thereto
- 3/505 . . . {for large machine windings, e.g. bar windings ([H02K 3/51](#) takes precedence)}
- 3/51 . . . . applicable to rotors only
- 3/52 . . . Fastening salient pole windings or connections thereto
- 3/521 . . . . {applicable to stators only}
- 3/522 . . . . . {for generally annular cores with salient poles}
- 3/524 . . . . . {for U-shaped, E-shaped or similarly shaped cores}
- 3/525 . . . . . {Annular coils, e.g. for cores of the claw-pole type}
- 3/527 . . . . {applicable to rotors only}
- 3/528 . . . . . {of the claw-pole type}
- 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. 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
- 5/128 . . . . using air-gap sleeves or air-gap discs
- 5/1282 . . . . . {the partition wall in the air-gap being non cylindrical}
- 5/1285 . . . . . {of the submersible type}
- 5/132 . . . . Submersible electric motors ([H02K 5/128](#) takes precedence)
- 5/136 . . . . explosion-proof
- 5/14 . . . Means for supporting or protecting brushes or brush holders
- 5/141 . . . . {for cooperation with slip-rings}
- 5/143 . . . . {for cooperation with commutators}

- 5/145 . . . . {Fixedly supported brushes or brush holders, e.g. leaf or leaf-mounted brushes}
- 5/146 . . . . {Pivotally supported brushes or brush holders}
- 5/148 . . . . {Slidably supported brushes}
- 5/15 . . Mounting arrangements for bearing-shields or end plates
- 5/16 . . Means for supporting bearings, e.g. insulating supports or means for fitting bearings in the bearing-shields ([magnetic bearings H02K 7/09](#))
- 5/161 . . . {radially supporting the rotary shaft at both ends of the rotor ([H02K 5/165](#), [H02K 5/167](#), [H02K 5/173](#) take precedence)}
- 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)}
- 5/165 . . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly ([H02K 5/167](#), [H02K 5/173](#) take precedence)}
- 5/167 . . . using sliding-contact or spherical cap bearings
- 5/1672 . . . . {radially supporting the rotary shaft at both ends of the rotor ([H02K 5/1677](#) takes precedence)}
- 5/1675 . . . . {radially supporting the rotary shaft at only one end of the rotor ([H02K 5/1677](#) takes precedence)}
- 5/1677 . . . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly}
- 5/173 . . . using bearings with rolling contact, e.g. ball bearings
- 5/1732 . . . . {radially supporting the rotary shaft at both ends of the rotor ([H02K 5/1737](#) takes precedence)}
- 5/1735 . . . . {radially supporting the rotary shaft at only one end of the rotor ([H02K 5/1737](#) takes precedence)}
- 5/1737 . . . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly}
- 5/18 . . with ribs or fins for improving heat transfer
- 5/20 . . with channels or ducts for flow of cooling medium
- 5/203 . . . {specially adapted for liquids, e.g. cooling jackets}
- 5/207 . . . {with openings in the casing specially adapted for ambient air}
- 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
- 5/225 . . . {Terminal boxes or connection arrangements ([specially adapted for submersible motors H02K 5/132](#))}
- 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**
- 7/003 . {Couplings; Details of shafts ([means for mounting rotors on shafts H02K 1/28](#))}
- 7/006 . {Structural association of a motor or generator with the drive train of a motor vehicle}
- 7/02 . Additional mass for increasing inertia, e.g. flywheels
- 7/025 . . {for power storage}
- 7/04 . Balancing means
- 7/06 . Means for converting reciprocating motion into rotary motion or *vice versa*
- 7/061 . . {using rotary unbalanced masses ([for generating mechanical vibrations in general B06B 1/16](#))}
- 7/063 . . . {integrally combined with motor parts, e.g. motors with eccentric rotors}
- 7/065 . . Electromechanical oscillators; Vibrating magnetic drives
- 7/07 . . using pawls and ratchet wheels
- 7/075 . . using crankshafts or eccentrics
- 7/08 . Structural association with bearings
- 7/081 . . {specially adapted for worm gear drives ([H02K 7/09](#) takes precedence)}
- 7/083 . . {radially supporting the rotary shaft at both ends of the rotor ([H02K 7/086](#), [H02K 7/09](#) take precedence)}
- 7/085 . . {radially supporting the rotary shaft at only one end of the rotor ([H02K 7/086](#), [H02K 7/09](#) take precedence)}
- 7/086 . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly ([H02K 7/09](#) takes precedence)}
- 7/088 . . . {radially supporting the rotor directly}
- 7/09 . . with magnetic bearings
- 7/10 . Structural association with clutches, brakes, gears, pulleys or mechanical starters
- NOTE**
- {Group [H02K 7/12](#) takes precedence over groups [H02K 7/102](#) - [H02K 7/118](#)}
- 7/1004 . . {with pulleys}
- 7/1008 . . . {structurally associated with the machine rotor ([H02K 7/1012](#) takes precedence)}
- 7/1012 . . . {Machine arranged inside the pulley}
- 7/1016 . . . . {Machine of the outer rotor type}
- 7/102 . . with friction brakes
- 7/1021 . . . {Magnetically influenced friction brakes}
- 7/1023 . . . . {using electromagnets}
- 7/1025 . . . . . {using axial electromagnets with generally annular air gap}
- 7/1026 . . . . {using stray fields}
- 7/1028 . . . . . {axially attracting the brake armature in the frontal area of the magnetic core}
- 7/104 . . with eddy-current brakes
- 7/106 . . with dynamo-electric brakes
- 7/108 . . with friction clutches
- 7/1085 . . . {Magnetically influenced friction clutches}
- 7/11 . . with dynamo-electric clutches
- 7/112 . . with friction clutches in combination with brakes
- 7/1125 . . . {Magnetically influenced friction clutches and brakes}
- 7/114 . . with dynamo-electric clutches in combination with brakes
- 7/116 . . with gears
- 7/1163 . . . {where at least two gears have non-parallel axes without having orbital motion}

- 7/1166 . . . . {comprising worm and worm-wheel (structural association with bearings specially adapted for worm gear drives [H02K 7/081](#))}
- 7/118 . . with starting devices
- 7/1185 . . . {with a mechanical one-way direction control, i.e. with means for reversing the direction of rotation of the rotor}
- 7/12 . . with auxiliary limited movement of stators, rotors or core parts, e.g. rotors axially movable for the purpose of clutching or braking
- 7/125 . . . {magnetically influenced}
- 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](#))
- 7/145 . . {Hand-held machine tool}
- 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
- 7/1807 . . {Rotary generators ([H02K 7/006](#) takes precedence)}
- 7/1815 . . . {structurally associated with reciprocating piston engines (general aspects of generating sets, e.g. housing, [F02B 63/04](#))}
- 7/1823 . . . {structurally associated with turbines or similar engines}
- 7/183 . . . . {wherein the turbine is a wind turbine (adaptation of a wind turbine to an electric generator [F03D 9/25](#))}
- 7/1838 . . . . {Generators mounted in a nacelle or similar structure of a horizontal axis wind turbine}
- 7/1846 . . . {structurally associated with wheels or associated parts (dynamos arranged in the wheel hub of cycles [B62J 6/12](#))}
- 7/1853 . . . {driven by intermittent forces}
- 7/1861 . . . {driven by animals or vehicles ([H02K 7/1853](#) takes precedence)}
- 7/1869 . . {Linear generators; sectional generators}
- 7/1876 . . . {with reciprocating, linearly oscillating or vibrating parts}
- 7/1884 . . . . {structurally associated with free piston engines}
- 7/1892 . . {Generators with parts oscillating or vibrating about an axis}
- 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
- 9/223 . . {Heat bridges}
- 9/225 . . {Heat pipes}
- 9/227 . . {Heat sinks}
- 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 electric components or with devices for shielding, monitoring or protection (casings, enclosures or supports [H02K 5/00](#))**
- 11/0094 . {Structural association with other electrical or electronic devices}
- 11/01 . for shielding from electromagnetic fields {, i.e. structural association with shields} (means for preventing or reducing eddy-current losses in the winding heads by shielding [H02K 3/42](#))
- 11/012 . . {Shields associated with rotating parts, e.g. rotor cores or rotary shafts}
- 11/014 . . {Shields associated with stationary parts, e.g. stator cores}
- 11/0141 . . . {Shields associated with casings, enclosures or brackets}
- 11/02 . for suppression of electromagnetic interference
- 11/026 . . Suppressors associated with brushes, brush holders or their supports
- 11/028 . . Suppressors associated with the rotor
- 11/04 . for rectification
- 11/042 . . Rectifiers associated with rotating parts, e.g. rotor cores or rotary shafts
- 11/049 . . Rectifiers associated with stationary parts, e.g. stator cores
- 11/05 . . . Rectifiers associated with casings, enclosures or brackets
- 11/20 . for measuring, monitoring, testing, protecting or switching (rectifiers [H02K 11/04](#); power electronics [H02K 11/33](#))

- 11/21 . . Devices for sensing speed or position, or actuated thereby ([specially adapted for machines having non-mechanical commutating devices H02K 29/06, H02K 29/14](#))
- 11/215 . . . Magnetic effect devices, e.g. Hall-effect or magneto-resistive elements
- 11/22 . . . Optical devices
- 11/225 . . . Detecting coils
- 11/23 . . . Mechanically-actuated centrifugal switches
- 11/24 . . Devices for sensing torque, or actuated thereby ([H02K 11/27 takes precedence](#))
- 11/25 . . Devices for sensing temperature, or actuated thereby
- 11/26 . . Devices for sensing voltage, or actuated thereby, e.g. overvoltage protection devices
- 11/27 . . Devices for sensing current, or actuated thereby ([overcurrent protection responsive to temperature of the machines or parts thereof, e.g. windings, H02K 11/25](#))
- 11/28 . . Manual switches
- 11/30 . Structural association with control circuits or drive circuits
- 11/33 . . Drive circuits, e.g. power electronics ([H02K 11/38 takes precedence](#))
- 11/35 . . Devices for recording or transmitting machine parameters, e.g. memory chips or radio transmitters for diagnosis
- 11/38 . . Control circuits or drive circuits associated with geared commutator motors of the worm-and-wheel type
- 11/40 . Structural association with grounding devices
- 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**
- 13/003 . {Structural associations of slip-rings}
- 13/006 . {Structural associations of commutators}
- 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
- 13/105 . . {Spark suppressors associated with the commutator}
- 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**
- 15/0006 . {Disassembling, repairing or modifying dynamo-electric machines ([repairing of cooling fluid boxes H02K 15/0093](#))}
- 15/0012 . {Manufacturing cage rotors}
- 15/0018 . {Applying slot closure means in the core; Manufacture of slot closure means}
- 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}
- 15/0031 . . {Shaping or compacting conductors in slots or around salient poles ([H02K 15/005 takes precedence](#))}
- 15/0037 . . {Shaping or compacting winding heads ([H02K 15/005, H02K 15/0087 and H02K 15/0428 take precedence](#))}
- 15/0043 . . . {Applying fastening means on winding headS ([fastening by applying resin, glue, varnish and similar means H02K 15/12](#))}
- 15/005 . . {by means of electrodynamic forces}
- 15/0056 . {Manufacturing winding connections}
- 15/0062 . . {Manufacturing the terminal arrangement [per se](#); Connecting the terminals to an external circuit}
- 15/0068 . . {Connecting winding sections; Forming leads; Connecting leads to terminals}
- 15/0081 . . . {for form-wound windings}
- 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](#))}
- 15/0093 . . . . {Manufacturing or repairing cooling fluid boxes, i.e. terminals of fluid cooled windings ensuring both electrical and fluid connection}
- 15/02 . of stator or rotor bodies
- 15/022 . . {with salient poles or claw-shaped poles}
- 15/024 . . {with slots}
- 15/026 . . . {Wound cores}
- 15/028 . . . {for fastening to casing or support, respectively to shaft or hub}
- 15/03 . . having permanent magnets
- 15/04 . of windings, prior to mounting into machines ([insulating windings H02K 15/10, H02K 15/12](#))
- 15/0407 . . {Windings manufactured by etching, printing or stamping the complete coil}
- 15/0414 . . {Windings consisting of separate elements, e.g. bars, hairpins, segments, half coils}
- 15/0421 . . . {consisting of single conductors, e.g. hairpins}
- 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](#))}
- 15/0435 . . {Wound windings}
- 15/0442 . . . {Loop windings ([manufacturing of windings consisting of overlapped loops H02K 15/0464](#))}
- 15/045 . . . . {Form wound coils}
- 15/0464 . . . {Lap windings ([when on diagonally wound hollow coils H02K 15/0492](#))}
- 15/0471 . . . . {manufactured by flattening a spiral winding}

- 15/0478 . . . {Wave windings, undulated windings (when on diagonally wound hollow coils [H02K 15/0492](#))}
- 15/0485 . . . . {manufactured by shaping an annular winding}
- 15/0492 . . . {Diagonally wound hollow coils}
- 15/06 . Embedding prefabricated windings in machines
- 15/061 . . {Air-gap windings}
- 15/062 . . {Windings in slots; salient pole windings}
- 15/063 . . . {Windings for large electric machines, e.g. bar windings (windings consisting of cables [H02K 15/065](#))}
- 15/064 . . . {Windings consisting of separate segments, e.g. hairpin windings ([H02K 15/063](#) takes precedence)}
- 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](#))}
- 15/066 . . . . {inserted perpendicularly to the axis of the slots or inter-polar channels}
- 15/067 . . . . {inserted in parallel to the axis of the slots or inter-polar channels}
- 15/068 . . . . . {Strippers}
- 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
- 15/105 . . {to the windings}
- 15/12 . Impregnating, heating or drying of windings, stators, rotors or machines
- 15/125 . . {Heating or drying of machines in operational state, e.g. standstill heating}
- 15/14 . Casings; Enclosures; Supports
- 15/16 . Centering rotors within the stator; Balancing rotors
- 15/165 . . {Balancing the rotor}
- 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](#))}
- 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](#))}
- 16/02 . Machines with one stator and two {or more} rotors
- 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](#))}
- 16/04 . Machines with one rotor and two stators
- 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
- WARNING**
- Groups [H02K 17/16](#), [H02K 17/168](#), [H02K 17/18](#) and [H02K 17/20](#) are incomplete pending reclassification of documents from group [H02K 17/165](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 17/165 . . . {characterised by the squirrel-cage or other short-circuited windings} (*Frozen*)
- WARNING**
- Group [H02K 17/165](#) is no longer used for the classification of documents as of May 1, 2023.
- The content of this group is being reclassified into groups [H02K 17/16](#), [H02K 17/168](#), [H02K 17/18](#) and [H02K 17/20](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 17/168 . . . {having single-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)
- 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	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}
19/08	. . . Motors having windings on the stator and a smooth rotor without windings of material with large hysteresis, e.g. hysteresis motors	21/04	. . Windings on magnets for additional excitation ; Windings and magnets for additional excitation
19/10	. . for multi-phase current	21/042	. . . {with permanent magnets and field winding both rotating}
19/103	. . . {Motors having windings on the stator and a variable reluctance soft-iron rotor without windings}	21/044	. . . . {Rotor of the claw pole type}
19/106	. . . {Motors having windings in the stator and a smooth rotor of material with large hysteresis without windings}	21/046	. . . {with rotating permanent magnets and stationary field winding}
19/12	. . . characterised by the arrangement of exciting windings, e.g. for self-excitation, compounding or pole-changing	21/048	. . . . {Rotor of the claw pole type}
19/14	. . having additional short-circuited windings for starting as asynchronous motors	21/10	. . Rotating armatures
19/16	. Synchronous generators	21/12	. with stationary armatures and rotating magnets
19/18	. . having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generators	21/125	. . {having an annular armature coil ( <a href="#">H02K 21/14</a> - <a href="#">H02K 21/24</a> take precedence)}
19/20	. . . with variable-reluctance soft-iron rotors without winding	21/14	. . with magnets rotating within the armatures
19/22	. . having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generators	21/145	. . . {having an annular armature coil (with homopolar co-operation <a href="#">H02K 21/20</a> )}
19/24	. . . with variable-reluctance soft-iron rotors without winding	21/16	. . . having annular armature cores with salient poles (with homopolar co-operation <a href="#">H02K 21/20</a> )
19/26	. . characterised by the arrangement of exciting windings	21/18	. . . having horse-shoe armature cores (with homopolar co-operation <a href="#">H02K 21/20</a> )
19/28	. . . for self-excitation	21/185	. . . . {with the axis of the rotor perpendicular to the plane of the armature}
19/30	. . . for compounding	21/20	. . . having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine
19/32	. . . for pole-changing	21/22	. . with magnets rotating around the armatures, e.g. flywheel magnetos
19/34	. . Generators with two or more outputs	21/222	. . . {Flywheel magnetos}
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	21/225	. . . . {having I-shaped, E-shaped or similarly shaped armature cores}
19/365	. . . {with a voltage regulator}	21/227	. . . {having an annular armature coil}
19/38	. . Structural association of synchronous generators with exciting machines	21/24	. . with magnets axially facing the armatures, e.g. hub-type cycle dynamos
<b>21/00</b>	<b>Synchronous motors having permanent magnets; Synchronous generators having permanent magnets</b>	21/26	. with rotating armatures and stationary magnets
21/02	. Details	21/28	. . with armatures rotating within the magnets
21/021	. . {Means for mechanical adjustment of the excitation flux}	21/30	. . . having annular armature cores with salient poles (with homopolar co-operation <a href="#">H02K 21/36</a> )
21/022	. . . {by modifying the relative position between field and armature, e.g. between rotor and stator (vectorial combination of field or armature sections <a href="#">H02K 21/029</a> )}	21/32	. . . having horse-shoe magnets (with homopolar co-operation <a href="#">H02K 21/36</a> )
21/023	. . . . {by varying the amount of superposition, i.e. the overlap, of field and armature}	21/325	. . . . {with the axis of the rotating armature perpendicular to the plane of the magnet}
21/024	. . . . {Radial air gap machines}	21/34	. . . having bell-shaped or bar-shaped magnets, e.g. for cycle lighting (with homopolar co-operation <a href="#">H02K 21/36</a> )
21/025	. . . . {by varying the thickness of the air gap between field and armature}	21/36	. . . with homopolar co-operation
21/026	. . . . {Axial air gap machines}	21/38	. with rotating flux distributors, and armatures and magnets both stationary
21/027	. . . . {Conical air gap machines}	21/40	. . with flux distributors rotating around the magnets and within the armatures
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}	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
		<b>23/00</b>	<b>DC commutator motors or generators having mechanical commutator; Universal AC/DC commutator motors</b>

23/02	. characterised by arrangement for exciting	<b>25/00</b>	<b>DC interrupter motors or generators</b>
23/023	. . {having short-circuited brushes}	<b>26/00</b>	<b>Machines adapted to function as torque motors, i.e. to exert a torque when stalled</b>
23/026	. . {having an unregular distribution of the exciting winding or of the excitation over the poles}	<b>27/00</b>	<b>AC commutator motors or generators having mechanical commutator</b>
23/04	. . having permanent magnet excitation	27/02	. characterised by the armature winding
23/06	. . having shunt connection of excitation windings	27/04	. having single-phase operation in series or shunt connection
23/08	. . having series connection of excitation windings	27/06	. . with a single or multiple short-circuited commutator, e.g. repulsion motor
23/10	. . having compound connection of excitation windings	27/08	. . with multiple-fed armature
23/12	. . having excitation produced by current sources independent of the armature circuit	27/10	. . with switching devices for different modes of operation, e.g. repulsion-induction motor
23/14	. . having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field	27/12	. having multi-phase operation
23/16	. . having angularly adjustable excitation field, e.g. by pole reversing or pole switching	27/14	. . in series connection
23/18	. . having displaceable main or auxiliary brushes	27/16	. . in shunt connection with stator feeding
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	27/18	. . in shunt connection with rotor feeding
23/22	. . having compensating or damping windings	27/20	. Structural association with a speed regulating device
23/24	. . having commutating-pole windings	27/22	. having means for improving commutation, e.g. auxiliary fields, double windings, double brushes
23/26	. characterised by the armature windings	27/24	. having two or more commutators
23/28	. . having open windings, i.e. not closed within the armatures	27/26	. having disc armature
23/30	. . having lap or loop windings	27/28	. Structural association with auxiliary electric devices influencing the characteristic of the machine or controlling the machine
23/32	. . having wave or undulating windings	27/30	. Structural association with auxiliary mechanical devices, e.g. with clutches or brakes
23/34	. . having mixed windings	<b>29/00</b>	<b>Motors or generators having non-mechanical commutating devices, e.g. discharge tubes or semiconductor devices</b>
23/36	. . having two or more windings; having two or more commutators; having two or more stators	29/03	. with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems
23/38	. . having winding or connection for improving commutation, e.g. equipotential connection	29/06	. with position sensing devices ( <a href="#">H02K 29/03 takes precedence</a> )
23/40	. characterised by the arrangement of the magnet circuits	29/08	. . using magnetic effect devices, e.g. Hall-plates, magneto-resistors ( <a href="#">H02K 29/12 takes precedence</a> )
23/405	. . {Machines with a special form of the pole shoes}	29/10	. . using light effect devices
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	29/12	. . using detecting coils { <a href="#">using the machine windings as detecting coil</a> }
23/44	. . having movable, e.g. turnable, iron parts	29/14	. with speed sensing devices ( <a href="#">H02K 29/03 takes precedence</a> )
23/46	. . having stationary shunts, i.e. magnetic cross flux	<b>31/00</b>	<b>Acyclic motors or generators, i.e. DC machines having drum or disc armatures with continuous current collectors</b>
23/48	. . having adjustable armatures	31/02	. with solid-contact collectors
23/50	. Generators with two or more outputs	31/04	. with at least one liquid-contact collector
23/52	. Motors acting also as generators, e.g. starting motors used as generators for ignition or lighting	<b>33/00</b>	<b>Motors with reciprocating, oscillating or vibrating magnet, armature or coil system (<a href="#">arrangements for handling mechanical energy structurally associated with motors H02K 7/00, e.g. H02K 7/06</a>)</b>
23/54	. Disc armature motors or generators	33/02	. with armatures moved one way by energisation of a single coil system and returned by mechanical force, e.g. by springs
23/56	. Motors or generators having iron cores separated from armature winding	33/04	. . wherein the frequency of operation is determined by the frequency of uninterrupted AC energisation
23/58	. Motors or generators without iron cores	33/06	. . . with polarised armatures
23/60	. Motors or generators having rotating armatures and rotating excitation field	33/08	. . . with DC energisation superimposed on AC energisation
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		
<b>24/00</b>	<b>Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn</b>		

- 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
- 37/04 . . with rotors situated within the stators
- 37/06 . . with rotors situated around the stators
- 37/08 . . with rotors axially facing the stators
- 37/10 . of permanent magnet type ([H02K 37/02](#) takes precedence)
- 37/12 . . with stationary armatures and rotating magnets
- 37/125 . . . {Magnet axially facing armature}
- 37/14 . . . with magnets rotating within the armatures
- 37/16 . . . . having horseshoe armature cores
- 37/18 . . . . of homopolar type
- 37/20 . . with rotating flux distributors, the armatures and magnets both being stationary
- 37/22 . Damping units
- 37/24 . Structural association with auxiliary mechanical devices
- 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 {(electromagnetic launchers [F41B 6/00](#))}**
- 41/02 . Linear motors; Sectional motors
- 41/025 . . Asynchronous motors
- 41/03 . . Synchronous motors; Motors moving step by step; Reluctance motors ([H02K 41/035](#) takes precedence)
- 41/031 . . . {of the permanent magnet type}
- 41/033 . . . . {with armature and magnets on one member, the other member being a flux distributor}
- 41/035 . . DC motors; Unipolar motors
- 41/0352 . . . {Unipolar motors}
- 41/0354 . . . . {Lorentz force motors, e.g. voice coil motors}
- 41/0356 . . . . . {moving along a straight path}
- 41/0358 . . . . . {moving along a curvilinear path}
- 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 {; Nutating motors, i.e. having the rotor axis parallel to the stator axis inclined with respect to the stator axis and performing a nutational movement as the rotor rolls on the stator}
- 41/065 . . {Nutating motors}
- 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**
- 44/02 . Electrodynamic pumps
- 44/04 . . Conduction pumps
- 44/06 . . Induction pumps
- 44/08 . Magnetohydrodynamic [MHD] generators
- 44/085 . . {with conducting liquids}
- 44/10 . . Constructional details of electrodes
- 44/12 . . Constructional details of fluid channels
- 44/14 . . . Circular or screw-shaped channels
- 44/16 . . Constructional details of the magnetic circuits
- 44/18 . . for generating AC power
- 44/20 . . . by changing the polarity of the magnetic field
- 44/22 . . . by changing the conductivity of the fluid
- 44/24 . . . by reversing the direction of fluid
- 44/26 . . . by creating a travelling magnetic field
- 44/28 . Association of MHD generators with conventional generators (nuclear power plants including a MHD generator [G21D 7/02](#))
- 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
- 49/043 . . . {with a radial airgap}
- 49/046 . . . {with an axial airgap}
- 49/06 . of the synchronous type {([H02K 49/10](#) takes precedence)}
- 49/065 . . {hysteresis type}

- 49/08 . of the collector armature type
- 49/10 . of the permanent-magnet type
- 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](#))}
- 49/104 . . {Magnetic couplings consisting of only two coaxial rotary elements, i.e. the driving element and the driven element}
- 49/106 . . . {with a radial air gap}
- 49/108 . . . {with an axial air gap}
- 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**
  - 55/02 . of the synchronous type
  - 55/04 . . with rotating field windings
  - 55/06 . of the homopolar type
- 99/00** **Subject matter not provided for in other groups of this subclass**
  - 99/10 . {Generators}
  - 99/20 . {Motors}
- 2201/00** **Specific aspects not provided for in the other groups of this subclass relating to the magnetic circuits**
  - 2201/03 . Machines characterised by aspects of the air-gap between rotor and stator
  - 2201/06 . Magnetic cores, or permanent magnets characterised by their skew
  - 2201/09 . Magnetic cores comprising laminations characterised by being fastened by caulking
  - 2201/12 . Transversal flux machines
  - 2201/15 . Sectional machines
  - 2201/18 . Machines moving with multiple degrees of freedom
- 2203/00** **Specific aspects not provided for in the other groups of this subclass relating to the windings**
  - 2203/03 . Machines characterised by the wiring boards, i.e. printed circuit boards or similar structures for connecting the winding terminations
  - 2203/06 . Machines characterised by the wiring leads, i.e. conducting wires for connecting the winding terminations
  - 2203/09 . Machines characterised by wiring elements other than wires, e.g. bus rings, for connecting the winding terminations
  - 2203/12 . Machines characterised by the bobbins for supporting the windings
  - 2203/15 . Machines characterised by cable windings, e.g. high-voltage cables, ribbon cables
- 2205/00** **Specific aspects not provided for in the other groups of this subclass relating to casings, enclosures, supports**
  - 2205/03 . Machines characterised by thrust bearings
  - 2205/06 . Machines characterised by means for keeping the brushes in a retracted position during assembly
- 2205/09 . Machines characterised by drain passages or by venting, breathing or pressure compensating means
- 2205/12 . Machines characterised by means for reducing windage losses or windage noise
- 2207/00** **Specific aspects not provided for in the other groups of this subclass relating to arrangements for handling mechanical energy**
  - 2207/03 . Tubular motors, i.e. rotary motors mounted inside a tube, e.g. for blinds
- 2209/00** **Specific aspects not provided for in the other groups of this subclass relating to systems for cooling or ventilating**
- 2211/00** **Specific aspects not provided for in the other groups of this subclass relating to measuring or protective devices or electric components**
  - 2211/03 . Machines characterised by circuit boards, e.g. pcb
- 2213/00** **Specific aspects, not otherwise provided for and not covered by codes [H02K 2201/00](#) - [H02K 2211/00](#)**
  - 2213/03 . Machines characterised by numerical values, ranges, mathematical expressions or similar information
  - 2213/06 . Machines characterised by the presence of fail safe, back up, redundant or other similar emergency arrangements
  - 2213/09 . Machines characterised by the presence of elements which are subject to variation, e.g. adjustable bearings, reconfigurable windings, variable pitch ventilators
  - 2213/12 . Machines characterised by the modularity of some components
- 2215/00** **Specific aspects not provided for in other groups of this subclass relating to methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing of dynamo-electric machines**