

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 are 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.

1/00	Details of the magnetic circuit (magnetic circuits for relays H01H 50/16)	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)}
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 rotor}
1/148	. . . . . {Sectional cores (H02K 1/141 takes precedence)}	1/2713	. . . . . {where the magnetisation axis of the magnets is axial}
1/16	. . . Stator cores with slots for windings	1/272	. . . . . {where the magnetisation axis of the magnets is radial or tangential}
1/165	. . . . {Shape, form or location of the slots}	1/2726	. . . . . {consisting of a single magnet or of a plurality of axially juxtaposed single magnets}
1/17	. . . Stator cores with permanent magnets		
1/18	. . . Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures	1/2733	. . . . . {Annular magnets}
1/182	. . . . {to stators axially facing the rotor, i.e. with axial or conical air gap}	1/274	. . . . . {consisting of a plurality of circumferentially positioned magnets}
1/185	. . . . {to outer stators}	1/2746	. . . . . {consisting of magnets arranged with the same polarity}
1/187	. . . . {to inner stators}	1/2753	. . . . . {consisting of magnets or groups of magnets arranged with alternating polarity}
1/20	. . . with channels or ducts for flow of cooling medium		
1/22	. . Rotating parts of the magnetic circuit	1/276	. . . . . {Magnets embedded in the magnetic core}
		1/2766	. . . . . {having a flux concentration effect}
		1/2773	. . . . . {consisting of tangentially magnetized radial magnets}

1/278	. . . . . {Surface mounted magnets; Inset magnets}	3/521	. . . {applicable to stators only}
1/2786	. . . . {Outer rotor}	3/522	. . . . {for generally annular cores with salient poles}
1/2793	. . . . {Rotor axially facing stator}	3/524	. . . . {for U-shaped, E-shaped or similarly shaped cores}
1/28	. . . Means for mounting or fastening rotating magnetic parts on to, or to, the rotor structures	3/525	. . . . {Annular coils, e.g. for cores of the claw-pole type}
1/30	. . . . using intermediate parts, e.g. spiders	3/527	. . . {applicable to rotors only}
1/32	. . . with channels or ducts for flow of cooling medium	3/528	. . . . {of the claw-pole type}
1/325	. . . . {between salient poles}	5/00	Casings; Enclosures; Supports
1/34	. . Reciprocating, oscillating or vibrating parts of the magnetic circuit	5/02	. Casings or enclosures characterised by the material thereof
3/00	Details of windings	5/04	. Casings or enclosures characterised by the shape, form or construction thereof
3/02	. Windings characterised by the conductor material	5/06	. . Cast metal casings
3/04	. Windings characterised by the conductor shape, form or construction, e.g. with bar conductors	5/08	. . Insulating casings
3/12	. . arranged in slots	5/10	. . with arrangements for protection from ingress, e.g. water or fingers
3/14	. . . with transposed conductors, e.g. twisted conductors	5/12	. . specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00)
3/16	. . . for auxiliary purposes, e.g. damping or commutating	5/124	. . . Sealing of shafts
3/18	. . Windings for salient poles	5/128	. . . using air-gap sleeves or air-gap discs
3/20	. . . for auxiliary purposes, e.g. damping or commutating	5/1282	. . . . {the partition wall in the air-gap being non cylindrical}
3/22	. . consisting of hollow conductors	5/1285	. . . . {of the submersible type}
3/24	. . with channels or ducts for cooling medium between the conductors	5/132	. . . Submersible electric motors (H02K 5/128 takes precedence)
3/26	. . consisting of printed conductors	5/136	. . . explosion-proof
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)	5/14	. . Means for supporting or protecting brushes or brush holders
3/30	. Windings characterised by the insulating material	5/141	. . . {for cooperation with slip-rings}
3/32	. Windings characterised by the shape, form or construction of the insulation	5/143	. . . {for cooperation with commutators}
3/325	. . {for windings on salient poles, such as claw-shaped poles}	5/145	. . . . {Fixedly supported brushes or brush holders, e.g. leaf or leaf-mounted brushes}
3/34	. . between conductors or between conductor and core, e.g. slot insulation	5/146	. . . . {Pivotally supported brushes or brush holders}
3/345	. . . {between conductor and core, e.g. slot insulation}	5/148	. . . . {Slidably supported brushes}
3/38	. . around winding heads, equalising connectors, or connections thereto	5/15	. . Mounting arrangements for bearing-shields or end plates
3/40	. . for high voltage, e.g. affording protection against corona discharges	5/16	. . Means for supporting bearings, e.g. insulating supports or means for fitting bearings in the bearing-shields (magnetic bearings H02K 7/09)
3/42	. Means for preventing or reducing eddy-current losses in the winding heads, e.g. by shielding	5/161	. . . {radially supporting the rotary shaft at both ends of the rotor (H02K 5/165 , H02K 5/167 , H02K 5/173 take precedence)}
3/44	. Protection against moisture or chemical attack; Windings specially adapted for operation in liquid or gas	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)}
3/46	. Fastening of windings on the stator or rotor structure	5/165	. . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly (H02K 5/167 , H02K 5/173 take precedence)}
3/47	. . Air-gap windings, i.e. iron-free windings	5/167	. . . using sliding-contact or spherical cap bearings
3/48	. . in slots	5/1672	. . . . {radially supporting the rotary shaft at both ends of the rotor (H02K 5/1677 takes precedence)}
3/487	. . . Slot-closing devices	5/1675	. . . . {radially supporting the rotary shaft at only one end of the rotor (H02K 5/1677 takes precedence)}
3/493	. . . . magnetic	5/1677	. . . . {radially supporting the rotor around a fixed spindle; radially supporting the rotor directly}
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		

- 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
- WARNING**
- Group [H02K 5/20](#) is impacted by reclassification into groups [H02K 5/203](#) and [H02K 5/207](#).
- Groups [H02K 5/20](#), [H02K 5/203](#), and [H02K 5/207](#) should be considered in order to perform a complete search.
- 5/203 . . . {specially adapted for liquids, e.g. cooling jackets}
- WARNING**
- Group [H02K 5/203](#) is incomplete pending reclassification of documents from group [H02K 5/20](#).
- Groups [H02K 5/20](#) and [H02K 5/203](#) should be considered in order to perform a complete search.
- 5/207 . . . {with openings in the casing specially adapted for ambient air}
- WARNING**
- Group [H02K 5/207](#) is incomplete pending reclassification of documents from group [H02K 5/20](#).
- Groups [H02K 5/20](#) and [H02K 5/207](#) should be considered in order to perform a complete search.
- 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
- WARNING**
Group [H02K 9/20](#) is impacted by reclassification into group [H02K 9/225](#).
Groups [H02K 9/20](#) and [H02K 9/225](#) should be considered in order to perform a complete search.
- 9/22 . by solid heat conducting material embedded in, or arranged in contact with, the stator or rotor, e.g. heat bridges
- WARNING**
Group [H02K 9/22](#) is impacted by reclassification into groups [H02K 9/223](#), [H02K 9/225](#), and [H02K 9/227](#).
All groups listed in this Warning should be considered in order to perform a complete search.
- 9/223 . . {Heat bridges}
- WARNING**
Group [H02K 9/223](#) is incomplete pending reclassification of documents from group [H02K 9/22](#).
Groups [H02K 9/22](#) and [H02K 9/223](#) should be considered in order to perform a complete search.
- 9/225 . . {Heat pipes}
- WARNING**
Group [H02K 9/225](#) is incomplete pending reclassification of documents from groups [H02K 9/20](#) and [H02K 9/22](#).
Groups [H02K 9/20](#), [H02K 9/22](#), and [H02K 9/225](#) should be considered in order to perform a complete search.

- 9/227 . . {Heat sinks}
- WARNING**
- Group [H02K 9/227](#) is incomplete pending reclassification of documents from group [H02K 9/22](#).
- Groups [H02K 9/22](#) and [H02K 9/227](#) should be considered in order to perform a complete search.
- 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](#))
- WARNING**
- Group [H02K 11/01](#) is incomplete pending reclassification of documents from group [H02K 11/022](#).
- Group [H02K 11/01](#) is also impacted by reclassification into groups [H02K 11/012](#), [H02K 11/014](#), and [H02K 11/0141](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 11/012 . . {Shields associated with rotating parts, e.g. rotor cores or rotary shafts}
- WARNING**
- Group [H02K 11/012](#) is incomplete pending reclassification of documents from groups [H02K 11/01](#) and [H02K 11/022](#).
- Groups [H02K 11/01](#), [H02K 11/022](#) and [H02K 11/012](#) should be considered in order to perform a complete search.
- 11/014 . . {Shields associated with stationary parts, e.g. stator cores}
- WARNING**
- Group [H02K 11/014](#) is incomplete pending reclassification of documents from groups [H02K 11/01](#) and [H02K 11/022](#).
- Groups [H02K 11/01](#), [H02K 11/022](#) and [H02K 11/014](#) should be considered in order to perform a complete search.
- 11/0141 . . . {Shields associated with casings, enclosures or brackets}
- WARNING**
- Group [H02K 11/0141](#) is incomplete pending reclassification of documents from groups [H02K 11/01](#) and [H02K 11/022](#).
- Groups [H02K 11/01](#), [H02K 11/022](#) and [H02K 11/0141](#) should be considered in order to perform a complete search.
- 11/02 . for suppression of electromagnetic interference
- 11/022 . . {Shields}
- (Frozen)
- WARNING**
- Group [H02K 11/022](#) is no longer used for the classification of documents as of August 1, 2020).
- The content of this group is being reclassified into groups [H02K 11/01](#)-[H02K 11/0141](#).
- Groups [H02K 11/022](#) and [H02K 11/01](#) - [H02K 11/0141](#) should be considered in order to perform a complete search.
- 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
- 11/044 . . {in motors ([H02K 11/042](#) takes precedence)}
- 11/046 . . {in generators ([H02K 11/042](#) takes precedence)}
- 11/048 . . . {Rectifiers combined with drive circuits in starter-generators}
- 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
- 17/165 . . . {characterised by the squirrel-cage or other short-circuited windings}
- 17/18 . . . having double-cage or multiple-cage rotors
- 17/185 {characterised by the double- or multiple cage windings}
- 17/20 . . . having deep-bar rotors
- 17/205 {characterised by the deep-bar windings}
- 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
- 19/08 . . . Motors having windings on the stator and a smooth rotor without windings of material with large hysteresis, e.g. hysteresis motors
- 19/10 . . for multi-phase current
- 19/103 . . . {Motors having windings on the stator and a variable reluctance soft-iron rotor without windings}
- 19/106 . . . {Motors having windings in the stator and a smooth rotor of material with large hysteresis without windings}
- 19/12 . . . characterised by the arrangement of exciting windings, e.g. for self-excitation, compounding or pole-changing
- 19/14 . . having additional short-circuited windings for starting as asynchronous motors
- 19/16 . Synchronous generators
- 19/18 . . having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generators
- 19/20 . . . with variable-reluctance soft-iron rotors without winding
- 19/22 . . having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generators
- 19/24 . . . with variable-reluctance soft-iron rotors without winding
- 19/26 . . characterised by the arrangement of exciting windings
- 19/28 . . . for self-excitation
- 19/30 . . . for compounding
- 19/32 . . . for pole-changing
- 19/34 . . Generators with two or more outputs
- 19/36 . . Structural association of synchronous generators with auxiliary electric devices influencing the characteristic of the generator or controlling the generator, e.g. with impedances or switches
- 19/365 . . . {with a voltage regulator}
- 19/38 . . Structural association of synchronous generators with exciting machines

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

- 21/02 . Details
- 21/021 . . {Means for mechanical adjustment of the excitation flux}
- 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](#))}
- 21/023 {by varying the amount of superposition, i.e. the overlap, of field and armature}
- 21/024 {Radial air gap machines}
- 21/025 {by varying the thickness of the air gap between field and armature}
- 21/026 {Axial air gap machines}
- 21/027 {Conical air gap machines}
- 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}
- 21/029 {Vectorial combination of the fluxes generated by a plurality of field sections or of the voltages induced in a plurality of armature sections}
- 21/04 . . Windings on magnets for additional excitation {; Windings and magnets for additional excitation}
- 21/042 . . . {with permanent magnets and field winding both rotating}
- 21/044 {Rotor of the claw pole type}
- 21/046 . . . {with rotating permanent magnets and stationary field winding}
- 21/048 {Rotor of the claw pole type}
- 21/10 . . Rotating armatures
- 21/12 . with stationary armatures and rotating magnets
- 21/125 . . {having an annular armature coil ([H02K 21/14](#) - [H02K 21/24](#) take precedence)}
- 21/14 . . with magnets rotating within the armatures
- 21/145 . . . {having an annular armature coil (with homopolar co-operation [H02K 21/20](#))}
- 21/16 . . . having annular armature cores with salient poles (with homopolar co-operation [H02K 21/20](#))
- 21/18 . . . having horse-shoe armature cores (with homopolar co-operation [H02K 21/20](#))
- 21/185 {with the axis of the rotor perpendicular to the plane of the armature}
- 21/20 . . . having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine
- 21/22 . . with magnets rotating around the armatures, e.g. flywheel magnetos
- 21/222 . . . {Flywheel magnetos}
- 21/225 {having I-shaped, E-shaped or similarly shaped armature cores}
- 21/227 . . . {having an annular armature coil}
- 21/24 . . with magnets axially facing the armatures, e.g. hub-type cycle dynamos
- 21/26 . with rotating armatures and stationary magnets
- 21/28 . . with armatures rotating within the magnets
- 21/30 . . . having annular armature cores with salient poles (with homopolar co-operation [H02K 21/36](#))

- 21/32 . . . having horse-shoe magnets (with homopolar co-operation [H02K 21/36](#))
- 21/325 {with the axis of the rotating armature perpendicular to the plane of the magnet}
- 21/34 . . . having bell-shaped or bar-shaped magnets, e.g. for cycle lighting (with homopolar co-operation [H02K 21/36](#))
- 21/36 . . . with homopolar co-operation
- 21/38 . with rotating flux distributors, and armatures and magnets both stationary
- 21/40 . . with flux distributors rotating around the magnets and within the armatures
- 21/42 . . with flux distributors rotating around the armatures and within the magnets
- 21/44 . . with armature windings wound upon the magnets
- 21/46 . Motors having additional short-circuited winding for starting as an asynchronous motor
- 21/48 . Generators with two or more outputs
- 23/00 DC commutator motors or generators having mechanical commutator; Universal AC/DC commutator motors**
- 23/02 . characterised by arrangement for exciting
- 23/023 . . {having short-circuited brushes}
- 23/026 . . {having an unregular distribution of the exciting winding or of the excitation over the poles}
- 23/04 . . having permanent magnet excitation
- 23/06 . . having shunt connection of excitation windings
- 23/08 . . having series connection of excitation windings
- 23/10 . . having compound connection of excitation windings
- 23/12 . . having excitation produced by current sources independent of the armature circuit
- 23/14 . . having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field
- 23/16 . . having angularly adjustable excitation field, e.g. by pole reversing or pole switching
- 23/18 . . having displaceable main or auxiliary brushes
- 23/20 . . having additional brushes spaced intermediately of the main brushes on the commutator, e.g. cross-field machines, metadynes, amplidynes or other armature-reaction excited machines
- 23/22 . . having compensating or damping windings
- 23/24 . . having commutating-pole windings
- 23/26 . characterised by the armature windings
- 23/28 . . having open windings, i.e. not closed within the armatures
- 23/30 . . having lap or loop windings
- 23/32 . . having wave or undulating windings
- 23/34 . . having mixed windings
- 23/36 . . having two or more windings; having two or more commutators; having two or more stators
- 23/38 . . having winding or connection for improving commutation, e.g. equipotential connection
- 23/40 . characterised by the arrangement of the magnet circuits
- 23/405 . . {Machines with a special form of the pole shoes}
- 23/42 . . having split poles, i.e. zones for varying reluctance by gaps in poles or by poles with different spacing of the air gap
- 23/44 . . having movable, e.g. turnable, iron parts
- 23/46 . . having stationary shunts, i.e. magnetic cross flux
- 23/48 . . having adjustable armatures
- 23/50 . Generators with two or more outputs

23/52	• Motors acting also as generators, e.g. starting motors used as generators for ignition or lighting	29/14	• with speed sensing devices (H02K 29/03 takes precedence)
23/54	• Disc armature motors or generators	31/00	Acyclic motors or generators, i.e. DC machines having drum or disc armatures with continuous current collectors
23/56	• Motors or generators having iron cores separated from armature winding	31/02	• with solid-contact collectors
23/58	• Motors or generators without iron cores	31/04	• with at least one liquid-contact collector
23/60	• Motors or generators having rotating armatures and rotating excitation field	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)
23/62	• Motors or generators with stationary armatures and rotating excitation field	33/02	• with armatures moved one way by energisation of a single coil system and returned by mechanical force, e.g. by springs
23/64	• Motors specially adapted for running on DC or AC by choice	33/04	• . wherein the frequency of operation is determined by the frequency of uninterrupted AC energisation
23/66	• Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine, e.g. with impedances or switches	33/06	• . . . with polarised armatures
23/68	• Structural association with auxiliary mechanical devices, e.g. with clutches or brakes	33/08	• . . . with DC energisation superimposed on AC energisation
24/00	Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn	33/10	• . wherein the alternate energisation and de-energisation of the single coil system is effected or controlled by movement of the armatures
25/00	DC interrupter motors or generators	33/12	• with armatures moving in alternate directions by alternate energisation of two coil systems
26/00	Machines adapted to function as torque motors, i.e. to exert a torque when stalled	33/14	• . wherein the alternate energisation and de-energisation of the two coil systems are effected or controlled by movement of the armatures
27/00	AC commutator motors or generators having mechanical commutator	33/16	• with polarised armatures moving in alternate directions by reversal or energisation of a single coil system
27/02	• characterised by the armature winding	33/18	• with coil systems moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnets
27/04	• having single-phase operation in series or shunt connection	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)
27/06	• . with a single or multiple short-circuited commutator, e.g. repulsion motor	35/02	• with moving magnets and stationary coil systems
27/08	• . with multiple-fed armature	35/04	• with moving coil systems and stationary magnets
27/10	• . with switching devices for different modes of operation, e.g. repulsion-induction motor	35/06	• with moving flux distributors, and both coil systems and magnets stationary
27/12	• having multi-phase operation	37/00	Motors with rotor rotating step by step and without interrupter or commutator driven by the rotor, e.g. stepping motors
27/14	• . in series connection	37/02	• of variable reluctance type
27/16	• . in shunt connection with stator feeding	37/04	• . with rotors situated within the stators
27/18	• . in shunt connection with rotor feeding	37/06	• . with rotors situated around the stators
27/20	• Structural association with a speed regulating device	37/08	• . with rotors axially facing the stators
27/22	• having means for improving commutation, e.g. auxiliary fields, double windings, double brushes	37/10	• of permanent magnet type (H02K 37/02 takes precedence)
27/24	• having two or more commutators	37/12	• . with stationary armatures and rotating magnets
27/26	• having disc armature	37/125	• . . {Magnet axially facing armature}
27/28	• Structural association with auxiliary electric devices influencing the characteristic of the machine or controlling the machine	37/14	• . . with magnets rotating within the armatures
27/30	• Structural association with auxiliary mechanical devices, e.g. with clutches or brakes	37/16	• . . . having horseshoe armature cores
29/00	Motors or generators having non-mechanical commutating devices, e.g. discharge tubes or semiconductor devices	37/18	• . . . of homopolar type
29/03	• with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems	37/20	• . with rotating flux distributors, the armatures and magnets both being stationary
29/06	• with position sensing devices (H02K 29/03 takes precedence)	37/22	• Damping units
29/08	• . using magnetic effect devices, e.g. Hall-plates, magneto-resistors (H02K 29/12 takes precedence)		
29/10	• . using light effect devices		
29/12	• . using detecting coils { using the machine windings as detecting coil }		

37/24	. Structural association with auxiliary mechanical devices	47/16	. . Single-armature converters, e.g. metadyne
39/00	Generators specially adapted for producing a desired non-sinusoidal waveform	47/18	. AC/AC converters
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)}	47/20	. . Motor/generators
41/02	. Linear motors; Sectional motors	47/22	. . Single-armature frequency converters with or without phase-number conversion
41/025	. . Asynchronous motors	47/24	. . . having windings for different numbers of poles
41/03	. . Synchronous motors; Motors moving step by step; Reluctance motors (H02K 41/035 takes precedence)	47/26	. . . operating as under- or over-synchronously running asynchronous induction machines, e.g. cascade arrangement of asynchronous and synchronous machines
41/031	. . . {of the permanent magnet type}	47/28	. . . operating as commutator machines with added slip-rings
41/033	. . . . {with armature and magnets on one member, the other member being a flux distributor}	47/30	. . Single-armature phase-number converters without frequency conversion
41/035	. . DC motors; Unipolar motors	49/00	Dynamo-electric clutches; Dynamo-electric brakes
41/0352	. . . {Unipolar motors}	49/02	. of the asynchronous induction type
41/0354	. . . . {Lorentz force motors, e.g. voice coil motors}	49/04	. . of the eddy-current hysteresis type
41/0356	. . . . . {moving along a straight path}	49/043	. . . {with a radial airgap}
41/0358	. . . . . {moving along a curvilinear path}	49/046	. . . {with an axial airgap}
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}	49/06	. of the synchronous type {(H02K 49/10 takes precedence)}
41/065	. . {Nutating motors}	49/065	. . {hysteresis type}
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	49/08	. of the collector armature type
44/02	. Electrodynamic pumps	49/10	. of the permanent-magnet type
44/04	. . Conduction pumps	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)}
44/06	. . Induction pumps	49/104	. . {Magnetic couplings consisting of only two coaxial rotary elements, i.e. the driving element and the driven element}
44/08	. Magnetohydrodynamic [MHD] generators	49/106	. . . {with a radial air gap}
44/085	. . {with conducting liquids}	49/108	. . . {with an axial air gap}
44/10	. . Constructional details of electrodes	49/12	. of the acyclic type
44/12	. . Constructional details of fluid channels	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
44/14	. . . Circular or screw-shaped channels	53/00	Alleged dynamo-electric perpetua mobilia
44/16	. . Constructional details of the magnetic circuits	55/00	Dynamo-electric machines having windings operating at cryogenic temperatures
44/18	. . for generating AC power	55/02	. of the synchronous type
44/20	. . . by changing the polarity of the magnetic field	55/04	. . with rotating field windings
44/22	. . . by changing the conductivity of the fluid	55/06	. of the homopolar type
44/24	. . . by reversing the direction of fluid	99/00	Subject matter not provided for in other groups of this subclass
44/26	. . . by creating a travelling magnetic field	99/10	. {Generators}
44/28	. Association of MHD generators with conventional generators (nuclear power plants including a MHD generator G21D 7/02)	99/20	. {Motors}
47/00	Dynamo-electric converters	2201/00	Specific aspects not provided for in the other groups of this subclass relating to the magnetic circuits
47/02	. AC/DC converters or vice versa	2201/03	. Machines characterised by aspects of the air-gap between rotor and stator
47/04	. . Motor/generators	2201/06	. Magnetic cores, or permanent magnets characterised by their skew
47/06	. . Cascade converters	2201/09	. Magnetic cores comprising laminations characterised by being fastened by caulking
47/08	. . Single-armature converters	2201/12	. Transversal flux machines
47/10	. . . with booster machines on the AC side	2201/15	. Sectional machines
47/12	. DC/DC converters		
47/14	. . Motor/generators		

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