

CPC COOPERATIVE PATENT CLASSIFICATION

H ELECTRICITY

(NOTE omitted)

H01 BASIC ELECTRIC ELEMENTS

(NOTE omitted)

H01F MAGNETS; INDUCTANCES; TRANSFORMERS; SELECTION OF MATERIALS FOR THEIR MAGNETIC PROPERTIES (ceramics based on ferrites [C04B 35/26](#); alloys [C22C](#); {construction of loading coils [H01B](#)} ; thermomagnetic devices [H01L 37/00](#); loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers [H04R](#))

NOTE

In this subclass, inductances and transformers are regarded as being "for power supply" if they are intended for this purpose even in systems operating at frequencies above 60 cycles/sec.

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 Magnets or magnetic bodies characterised by the magnetic materials therefor; Selection of materials for their magnetic properties

NOTES

1. Attention is drawn to Note (3) after the title of section [C](#), which Note indicates to which version of the periodic table of chemical elements the IPC refers. In this group, the Periodic System used is the 8 group system indicated by Roman numerals in the Periodic Table thereunder.

2. {Group [H01F 1/0036](#) takes precedence over groups [H01F 1/09](#), [H01F 1/11](#), [H01F 1/20](#), [H01F 1/33](#) and [H01F 1/36](#)}

- 1/0009 . {Antiferromagnetic materials, i.e. materials exhibiting a Néel transition temperature ([H01F 1/0036](#) takes precedence)}
- 1/0018 . {Diamagnetic or paramagnetic materials, i.e. materials with low susceptibility and no hysteresis ([H01F 1/0036](#) takes precedence)}
- 1/0027 . {Thick magnetic films (forming thick magnetic films [H01F 41/16](#))}
- 1/0036 . {showing low dimensional magnetism, i.e. spin rearrangements due to a restriction of dimensions, e.g. showing giant magnetoresistivity, ([H01F 1/153](#), [H01F 1/42](#) and [H01F 10/00](#) take precedence; magnetoresistive sensors [G01D 5/16](#), [G01R 33/06](#); magnetoresistive recording [G11B 5/39](#); magnetic-field-controlled resistors [H01L 43/08](#))}
- 1/0045 . . {Zero dimensional, e.g. nanoparticles, soft nanoparticles for medical/biological use (preparation of fullerenes in general [C01B 32/15](#))}
- 1/0054 . . . {Coated nanoparticles, e.g. nanoparticles coated with organic surfactant}
- 1/0063 . . . {in a non-magnetic matrix, e.g. granular solids (granular films [H01F 10/007](#))}
- 1/0072 . . {one dimensional, i.e. linear or dendritic nanostructures}

- 1/0081 . . . {in a non-magnetic matrix, e.g. Fe-nanowires in a nanoporous membrane}
- 1/009 . . {bidimensional, e.g. nanoscale period nanomagnet arrays ([H01F 10/007](#) takes precedence)}
- 1/01 . of inorganic materials ([H01F 1/44](#) takes precedence)
- 1/012 . . {adapted for magnetic entropy change by magnetocaloric effect, e.g. used as magnetic refrigerating material (refrigeration systems using magnetic effects [F25B 21/00](#))}
- 1/015 . . . {Metals or alloys}
- 1/017 . . . {Compounds}
- 1/03 . . characterised by their coercivity {([H01F 1/40](#) takes precedence)}
- 1/0302 . . . {characterised by unspecified or heterogeneous hardness or specially adapted for magnetic hardness transitions}
- 1/0304 {adapted for large Barkhausen jumps or domain wall rotations, e.g. WIEGAND or MATTEUCCI effect ([H01F 1/143](#) and [H01F 1/15391](#) take precedence)}
- 1/0306 {Metals or alloys, e.g. LAVES phase alloys of the MgCu₂-type ([H01F 1/0304](#) takes precedence)}
- 1/0308 {with magnetic shape memory [MSM], i.e. with lattice transformations driven by a magnetic field, e.g. Heusler alloys}
- 1/0311 {Compounds ([H01F 1/0304](#) takes precedence)}
- 1/0313 {Oxidic compounds}
- 1/0315 {Ferrites}
- 1/0317 {Manganites}
- 1/032 . . . of hard-magnetic materials
- 1/04 metals or alloys

1/047	. . . . .	Alloys characterised by their composition
		NOTE
		In groups H01F 1/053 - H01F 1/059 , an alloy is classified in the last appropriate place
1/053	. . . . .	containing rare earth metals
1/0533	. . . . .	{ in a bonding agent }
1/0536	. . . . .	{ sintered }
1/055	. . . . .	and magnetic transition metals, e.g. SmCo ₅
1/0551	. . . . .	{ in the form of particles, e.g. rapid quenched powders or ribbon flakes }
1/0552	. . . . .	{ with a protective layer }
1/0553	. . . . .	{ obtained by reduction or by hydrogen decrepitation or embrittlement }
1/0555	. . . . .	{ pressed, sintered or bonded together }
1/0556	. . . . .	{ pressed }
1/0557	. . . . .	{ sintered }
1/0558	. . . . .	{ bonded together }
1/057	. . . . .	and IIIa elements, e.g. Nd ₂ Fe ₁₄ B
1/0571	. . . . .	{ in the form of particles, e.g. rapid quenched powders or ribbon flakes }
1/0572	. . . . .	{ with a protective layer }
1/0573	. . . . .	{ obtained by reduction or by hydrogen decrepitation or embrittlement }
1/0574	. . . . .	{ obtained by liquid dynamic compaction }
1/0575	. . . . .	{ pressed, sintered or bonded together }
1/0576	. . . . .	{ pressed, e.g. hot working }
1/0577	. . . . .	{ sintered }
1/0578	. . . . .	{ bonded together }
1/0579	. . . . .	{ with exchange spin coupling between hard and soft nanophases, e.g. nanocomposite spring magnets }
1/058	. . . . .	and IVa elements, e.g. Gd ₂ Fe ₁₄ C
1/059	. . . . .	and Va elements, e.g. Sm ₂ Fe ₁₇ N ₂
1/0593	. . . . .	{ of tetragonal ThMn ₁₂ -structure }
1/0596	. . . . .	{ of rhombic or rhombohedral Th ₂ Zn ₁₇ structure or hexagonal Th ₂ Ni ₁₇ structure }
1/06	. . . . .	in the form of particles, e.g. powder (H01F 1/047 takes precedence {; record carriers G11B 5/70605 })
1/061	. . . . .	{ with a protective layer }
1/063	. . . . .	{ with a non magnetic core }
1/065	. . . . .	{ obtained by a reduction }
1/066	. . . . .	{ obtained by liquid dynamic compaction }
1/068	. . . . .	{ having a L10 crystallographic structure, e.g. [Co,Fe][Pt,Pd] (nano)particles }
1/08	. . . . .	pressed, sintered, or bound together
1/083	. . . . .	{ in a bonding agent }
1/086	. . . . .	{ sintered }

1/09	. . . . .	mixtures of metallic and non-metallic particles; metallic particles having oxide skin
1/10	. . . . .	non-metallic substances, e.g. ferrites {, e.g. [(Ba,Sr)O(Fe ₂ O ₃) ₆] ferrites with hexagonal structure }
1/11	. . . . .	in the form of particles { (for magnetic record carriers G11B 5/70626) }
1/111	. . . . .	{ with a non-magnetic core }
1/112	. . . . .	{ with a skin (H01F 1/113 takes precedence) }
1/113	. . . . .	in a bonding agent
1/117	. . . . .	Flexible bodies
1/12	. . . . .	of soft-magnetic materials
1/14	. . . . .	metals or alloys
1/143	. . . . .	{ in the form of wires (H01F 1/147 takes precedence) }
1/147	. . . . .	Alloys characterised by their composition { (treatment thereof for enhancing their electromagnetic properties C21D 8/12) }
		NOTE
		In groups H01F 1/14708 - H01F 1/15391 , an alloy is classified in the last appropriate place
1/14708	. . . . .	{ Fe-Ni based alloys (pure Fe or Ni H01F 1/14 , H01F 1/16 or H01F 1/20) }
1/14716	. . . . .	{ in the form of sheets }
1/14725	. . . . .	{ with insulating coating }
1/14733	. . . . .	{ in the form of particles }
1/14741	. . . . .	{ pressed, sintered or bonded together }
1/1475	. . . . .	{ the particles being insulated }
1/14758	. . . . .	{ by macromolecular organic substances }
1/14766	. . . . .	{ Fe-Si based alloys }
1/14775	. . . . .	{ in the form of sheets }
1/14783	. . . . .	{ with insulating coating }
1/14791	. . . . .	{ Fe-Si-Al based alloys, e.g. Sendust }
1/153	. . . . .	Amorphous metallic alloys, e.g. glassy metals { (making ferrous amorphous alloys C22C 33/003) }
1/15308	. . . . .	{ based on Fe/Ni (H01F 1/15325 takes precedence) }
1/15316	. . . . .	{ based on Co (H01F 1/15325 takes precedence) }
1/15325	. . . . .	{ containing rare earths }
1/15333	. . . . .	{ containing nanocrystallites, e.g. obtained by annealing }
1/15341	. . . . .	{ Preparation processes therefor }
1/1535	. . . . .	{ by powder metallurgy, e.g. spark erosion }
1/15358	. . . . .	{ Making agglomerates therefrom, e.g. by pressing }
1/15366	. . . . .	{ using a binder }
1/15375	. . . . .	{ using polymers }
1/15383	. . . . .	{ Applying coatings thereon (H01F 1/15366 takes precedence) }
1/15391	. . . . .	{ Elongated structures, e.g. wires }
1/16	. . . . .	in the form of sheets (H01F 1/147 takes precedence)
1/18	. . . . .	with insulating coating

- 1/20 in the form of particles, e.g. powder
([H01F 1/147](#) takes precedence)
- 1/22 pressed, sintered, or bound together
- 1/24 the particles being insulated
- 1/26 by macromolecular organic substances
- 1/28 dispersed or suspended in a bonding agent
- 1/33 mixtures of metallic and non-metallic particles; metallic particles having oxide skin
- 1/34 non-metallic substances, e.g. ferrites
- 1/342 {Oxides ([H01F 1/36](#) and [H01F 1/38](#) take precedence)}
- 1/344 {Ferrites, e.g. having a cubic spinel structure (X₂+O)(Y₂+O₃), e.g. magnetite Fe₃O₄}
- 1/346 {[(TO₄)₃] with T= Si, Al, Fe, Ga
([H01F 10/24](#) takes precedence;
Faraday rotators [G02F 1/09](#))}
- 1/348 {Hexaferrites with decreased hardness or anisotropy, i.e. with increased permeability in the microwave (GHz) range, e.g. having a hexagonal crystallographic structure}
- 1/36 in the form of particles ([H01F 1/346](#),
[H01F 1/348](#) and [H01F 1/38](#) take precedence)}
- 1/37 in a bonding agent
- 1/375 Flexible bodies
- 1/38 amorphous, e.g. amorphous oxides
- 1/40 . . . of magnetic semiconductor materials, e.g. CdCr₂S₄ (devices using galvano-magnetic or similar effects [H01L 43/00](#))
- 1/401 . . . {diluted}

NOTE

In group [H01F 1/401](#), a diluted magnetic semiconductor (DMS) is classified in the last appropriate place

- 1/402 {of II-VI type, e.g. Zn_{1-x}Cr_xSe}
- 1/404 {of III-V type, e.g. In_{1-x}Mn_xAs}
- 1/405 {of IV type, e.g. Ge_{1-x}Mn_x}
- 1/407 {Diluted non-magnetic ions in a magnetic cation-sublattice, e.g. perovskites, La_{1-x}(Ba,Sr)_xMnO₃}
- 1/408 . . . {half-metallic, i.e. having only one electronic spin direction at the Fermi level, e.g. CrO₂, Heusler alloys ([H01F 10/1936](#) takes precedence)}
- 1/42 . . . of organic or organo-metallic materials {, e.g. graphene}([H01F 1/44](#) takes precedence)
- 1/44 . . . of magnetic liquids, e.g. ferrofluids (particles in a bonding agent [H01F 1/28](#), [H01F 1/36](#),
([H01F 1/37](#))}
- 1/442 . . . {the magnetic component being a metal or alloy, e.g. Fe ([H01F 1/447](#) takes precedence)}
- 1/445 . . . {the magnetic component being a compound, e.g. Fe₃O₄ ([H01F 1/447](#) takes precedence)}
- 1/447 . . . {characterised by magnetoviscosity, e.g. magnetorheological, magnetorheototropic, magnetodilatant liquids (electrorheological fluids [C10M 171/001](#))}

3/00**Cores, Yokes, or armatures (magnetic materials [H01F 1/00](#); permanent magnets [H01F 7/02](#))**

- 2003/005 . . {Magnetic cores for receiving several windings with perpendicular axes, e.g. for antennae or inductive power transfer}
- 3/02 . . made from sheets
- 3/04 . . made from strips or ribbons
- 3/06 . . made from wires
- 3/08 . . made from powder (powder coatings on sheets [H01F 3/02](#); on strips or ribbons [H01F 3/04](#); on wires [H01F 3/06](#))
- 3/10 . . Composite arrangements of magnetic circuits
- 2003/103 . . {Magnetic circuits with permanent magnets}
- 2003/106 . . {Magnetic circuits using combinations of different magnetic materials}
- 3/12 . . Magnetic shunt paths
- 3/14 . . Constrictions; Gaps, e.g. air-gaps (in magnetic shunt paths [H01F 3/12](#))

5/00**Coils (superconducting coils [H01F 6/06](#); fixed inductances of the signal type [H01F 17/00](#))**

- 5/003 . . {Printed circuit coils}
- 2005/006 . . {with conical spiral form}
- 5/02 . . wound on non-magnetic supports, e.g. formers
- 2005/022 . . {wound on formers with several winding chambers separated by flanges, e.g. for high voltage applications}
- 2005/025 . . {wound on coaxial arrangement of two or more formers}
- 2005/027 . . {wound on formers for receiving several coils with perpendicular winding axes, e.g. for antennae or inductive power transfer}
- 5/04 . . Arrangements of electric connections to coils, e.g. leads
- 2005/043 . . {having multiple pin terminals, e.g. arranged in two parallel lines at both sides of the coil}
- 2005/046 . . {Details of formers and pin terminals related to mounting on printed circuits}
- 5/06 . . Insulation of windings

6/00**Superconducting magnets; Superconducting coils {(magnetic resonance assemblies using superconducting coil systems [G01R 33/3815](#))}**

- 2006/001 . . {Constructive details of inductive current limiters}
- 6/003 . . {Methods and means for discharging superconductive storage (superconducting alloys [C22C](#); static memories with superconducting elements [G11C 11/44](#); superconducting circuit breakers with contacts [H01H 33/004](#); superconducting material [H01L 39/00](#); power cryotons [H01L 39/20](#); superconducting switches for low power [H03K 17/92](#))}
- 6/005 . . {Methods and means for increasing the stored energy in superconductive coils by increments (flux pumps)}
- 6/006 . . {Supplying energising or de-energising current; Flux pumps}
- 6/008 . . {Electric circuit arrangements for energising superconductive electromagnets}
- 6/02 . . Quenching; Protection arrangements during quenching {(protection circuits [H02H 7/001](#))}
- 6/04 . . Cooling
- 6/06 . . Coils, e.g. winding, insulating, terminating or casing arrangements therefor

- 6/065 . . {Feed-through bushings, terminals and joints (leading of conductors or axes through casings of transformers [H01F 27/04](#))}
- 7/00 Magnets** (superconducting magnets [H01F 6/00](#); for separation of solid materials or fluids [B03C 1/00](#); for bench or like work-holders [B23B 31/28](#), [B23Q 3/00](#); work-holding devices [B25B 11/00](#); lifting magnets [B66C 1/00](#); {operating or controlling locks using permanent magnets [E05B 47/0038](#); devices for holding a wing, e.g. door or window, by magnetic or electromagnetic attraction [E05C 19/16](#); relieving load or bearings using magnetic means [F16C 39/06](#)} ; for electric meters [G01R](#); for relays [H01H](#); {for electric discharge tubes [H01J](#), e.g. [H01J 3/24](#), [H01J 23/10](#), [H01J 29/68](#)} ; for dynamo-electric machines [H02K](#))
- 7/02 . Permanent magnets {[PM]}
- 7/0205 . . {Magnetic circuits with PM in general}
- 7/021 . . . {Construction of PM ([H01F 7/0278](#) takes precedence; PM compositions [H01F 1/032](#))}
- 7/0215 {Flexible forms, sheets}
- 7/0221 . . . {Mounting means for PM, supporting, coating, encapsulating PM}
- 7/0226 . . . {PM with variable field strength ([H01F 7/0284](#) takes precedence)}
- 7/0231 . . {Magnetic circuits with PM for power or force generation}
- 7/0236 . . . {Magnetic suspension or levitation (for vehicles [B60L 13/04](#); magnetic bearings [F16C 39/063](#))}
- 7/0242 . . . {Magnetic drives, magnetic coupling devices}
- 7/0247 . . . {Orientating, locating, transporting arrangements}
- 7/0252 . . . {PM holding devices ([H01F 7/021](#), [H01F 7/0215](#), [H01F 7/0226](#) take precedence)}
- 7/0257 {Lifting, pick-up magnetic objects}
- 7/0263 {Closures, bags, bands, engagement devices with male and female parts}
- 7/0268 {Magnetic cylinders}
- 7/0273 . . {Magnetic circuits with PM for magnetic field generation}
- 7/0278 . . . {for generating uniform fields, focusing, deflecting electrically charged particles (for magnetic separation by Lorentz force [B03C 1/023](#); specially adapted for NMR applications [G01R 33/383](#))}
- 7/0284 {using a trimmable or adjustable magnetic circuit, e.g. for a symmetric dipole or quadrupole magnetic field}
- 7/0289 . . . {Transducers, loudspeakers, moving coil arrangements}
- 7/0294 . . . {Detection, inspection, magnetic treatment}
- 7/04 . . Means for releasing the attractive force
- 7/06 . Electromagnets; Actuators including electromagnets {(electric coils [H01F 5/00](#); devices for holding workpieces using electric force [B23Q 3/15](#); load-engaging elements for lifting articles electromagnetically [B66C 1/06](#); electromagnetic couplings [F16D 27/00](#); magnetic brakes [F16D 63/002](#); electromagnetically operated valves [F16K 11/24](#), [F16K 31/00](#); analysing materials by magnetic means [G01N 27/72](#), [G01N 27/80](#); electromagnets for winding mechanical clocks [G04C 1/02](#); electromagnetic relays [H01H 51/00](#); windings for salient poles of dynamo-electric machines [H02K 3/18](#); electromagnets for telegraphic communication [H04L](#); for arc lamps [H05B 31/28](#))}
- 2007/062 . . {Details of terminals or connectors for electromagnets}
- 7/064 . . {Circuit arrangements for actuating electromagnets (circuit arrangements for obtaining special operating characteristics [H01F 7/18](#); driving circuits for electromagnets making use of a switching regulator [H01H 47/325](#))}
- 7/066 . . {Electromagnets with movable winding}
- 2007/068 . . {using printed circuit coils}
- 7/08 . . with armatures
- 7/081 . . . {Magnetic constructions}
- 2007/083 {External yoke surrounding the coil bobbin, e.g. made of bent magnetic sheet}
- 2007/085 {Yoke or polar piece between coil bobbin and armature having a gap, e.g. filled with nonmagnetic material}
- 2007/086 {Structural details of the armature}
- 7/088 . . . {provided with means for absorbing shocks}
- 7/10 . . . specially adapted for alternating current
- 7/11 reducing or eliminating the effects of eddy currents
- 7/12 having anti-chattering arrangements
- 7/1205 {having short-circuited conductors (electromagnetic relays provided with short-circuited conducting sleeves [H01H 47/00](#))}
- 7/121 . . . Guiding or setting position of armatures, e.g. retaining armatures in their end position
- 7/122 by permanent magnets {([H01F 7/1615](#), [H01F 7/1646](#) take precedence)}
- 7/123 by ancillary coil
- 7/124 by mechanical latch, e.g. detent
- 7/126 . . . Supporting or mounting
- 7/127 . . . Assembling
- 7/128 . . . Encapsulating, encasing or sealing
- 7/129 of armatures
- 7/13 . . . characterised by pulling-force characteristics
- 7/14 . . . Pivoting armatures ([H01F 7/17](#) takes precedence)
- 7/145 {Rotary electromagnets with variable gap (with fixed gap or torque motors [H02K 26/00](#))}
- 7/16 . . . Rectilinearly-movable armatures ([H01F 7/17](#) takes precedence)
- 7/1607 {Armatures entering the winding}
- 7/1615 {Armatures or stationary parts of magnetic circuit having permanent magnet}
- 7/1623 {Armatures having T-form}

2007/163	. . . . .	{with axial bearing}	7/202	. . . . .	{Electromagnets for high magnetic field strength (for superconducting electromagnets H01F 6/00 ; for transformers or inductances without a magnetic core H01F 30/08)}
7/1638	. . . . .	{Armatures not entering the winding}	7/204	. . . . .	{Circuits for energising or de-energising}
7/1646	. . . . .	{Armatures or stationary parts of magnetic circuit having permanent magnet}	7/206	. . . . .	{Electromagnets for lifting, handling or transporting of magnetic pieces or material (electromagnets for guidance of vehicles, workpieces B65G 21/2009 ; for magnetic suspension or levitation H02N 15/00)}
7/1653	. . . . .	{Magnetic circuit having axially spaced pole-pieces}	2007/208	. . . . .	{combined with permanent magnets}
2007/1661	. . . . .	{Electromagnets or actuators with anti-stick disc}	10/00		Thin magnetic films, e.g. of one-domain structure (magnetic record carriers G11B 5/00 ; thin-film magnetic stores G11C)
2007/1669	. . . . .	{Armatures actuated by current pulse, e.g. bistable actuators}	10/002	. . . . .	{Antiferromagnetic thin films, i.e. films exhibiting a Néel transition temperature (H01F 10/3218 and H01F 10/3268 take precedence)}
2007/1676	. . . . .	{Means for avoiding or reducing eddy currents in the magnetic circuit, e.g. radial slots}	10/005	. . . . .	{organic or organo-metallic films, e.g. monomolecular films obtained by Langmuir-Blodgett technique, graphene}
2007/1684	. . . . .	{Armature position measurement using coils}	10/007	. . . . .	{ultrathin or granular films (H01F 10/005 and H01F 10/3227 take precedence; applying ultrathin or granular layers to substrates H01F 41/301)}
2007/1692	. . . . .	{Electromagnets or actuators with two coils}	10/06	. . . . .	characterised by the coupling or physical contact with connecting or interacting conductors
7/17	. . . . .	Pivoting and rectilinearly-movable armatures	10/08	. . . . .	characterised by magnetic layers (H01F 10/32 takes precedence) ; applying thin magnetic films to substrates H01F 41/14)
7/18	. . . . .	Circuit arrangements for obtaining desired operating characteristics, e.g. for slow operation, for sequential energisation of windings, for high-speed energisation of windings	10/10	. . . . .	characterised by the composition
7/1805	. . . . .	{Circuit arrangements for holding the operation of electromagnets or for holding the armature in attracted position with reduced energising current (for holding relay armature in attracted position with reduced energising current H01H 47/04 ; quick energising of electro-dynamic machines H02P 9/08 ; for quickly de-energising of dynamo-electric generators H02P 9/123)}	10/12	. . . . .	being metals or alloys (intermetallic compounds H01F 10/18)
7/1811	. . . . .	{demagnetising upon switching off, removing residual magnetism}	10/123	. . . . .	{having a L10 crystallographic structure, e.g. [Co,Fe][Pt,Pd] thin films}
7/1816	. . . . .	{making use of an energy accumulator (for relays H01H 47/043)}	10/126	. . . . .	{containing rare earth metals (H01F 10/133 takes precedence)}
2007/1822	. . . . .	{using a capacitor to produce a boost voltage}	10/13	. . . . .	Amorphous metallic alloys, e.g. glassy metals (H01F 10/3204 takes precedence)
7/1827	. . . . .	{by changing number of serially-connected turns or windings (for relays H01H 47/06)}	NOTE		In this group, amorphous metallic alloys are classified in the last appropriate place
7/1833	. . . . .	{by changing number of parallel-connected turns or windings (for relays H01H 47/08)}	10/131	. . . . .	{containing iron or nickel}
7/1838	. . . . .	{by switching-in or -out impedance (for relays H01H 47/10)}	10/132	. . . . .	{containing cobalt}
7/1844	. . . . .	{Monitoring or fail-safe circuits (for relays H01H 47/002)}	10/133	. . . . .	{containing rare earth metals}
2007/185	. . . . .	{with armature position measurement}	10/135	. . . . .	{containing transition metals}
2007/1855	. . . . .	{using a stored table to deduce one variable from another}	10/136	. . . . .	{containing iron}
2007/1861	. . . . .	{using derivative of measured variable}	10/137	. . . . .	{containing cobalt}
2007/1866	. . . . .	{with regulation loop}	10/138	. . . . .	{containing nanocrystallites, e.g. obtained by annealing}
7/1872	. . . . .	{Bistable or bidirectional current devices (relays H01H 47/226)}	10/14	. . . . .	containing iron or nickel (H01F 10/126 , H01F 10/13 , H01F 10/16 take precedence)
7/1877	. . . . .	{controlling a plurality of loads}	NOTE		In this group, alloys containing iron or nickel are classified in the last appropriate place
7/1883	. . . . .	{by steepening leading and trailing edges of magnetisation pulse, e.g. printer drivers}	10/142	. . . . .	{containing Si}
2007/1888	. . . . .	{using pulse width modulation}	10/145	. . . . .	{containing Al, e.g. SENDUST}
2007/1894	. . . . .	{minimizing impact energy on closure of magnetic circuit}	10/147	. . . . .	{with lattice under strain, e.g. expanded by interstitial nitrogen (H01F 10/26 - H01F 10/30 take precedence)}
7/20	. . . . .	without armatures (cores H01F 3/00 ; coils H01F 5/00 ; shaping metal by applying magnetic forces B21D 26/14 ; electromagnets specially adapted for NMR applications G01R 33/381)			

- 10/16 containing cobalt ([H01F 10/126](#) ,
[H01F 10/13](#) take precedence)
- 10/18 being compounds
- 10/187 Amorphous compounds ([H01F 10/3204](#)
takes precedence)
- 10/193 Magnetic semiconductor compounds
{(in general [H01F 1/40](#); multilayers, e.g.
superlattices [H01F 10/3213](#))}
- 10/1933 {Perovskites}
- 10/1936 {Half-metallic, e.g. epitaxial CrO₂ or
NiMnSb films}
- 10/20 Ferrites
- 10/205 {Hexagonal ferrites}
- 10/22 Orthoferrites {, e.g. RFeO₃ (R= rare earth
element) with orthorhombic structure}
- 10/24 Garnets {(in general [H01F 1/346](#);
multilayers, e.g. superlattices
[H01F 10/3209](#); applying magnetic
garnet films to substrates by sputtering
[H01F 41/186](#))}
- 10/245 {Modifications for enhancing
interaction with electromagnetic wave
energy}
- 10/26 . characterised by the substrate or intermediate layers
{([H01F 10/06](#) and [H01F 10/32](#) take precedence)}
- 10/265 . . {Magnetic multilayers non exchange-coupled
([H01F 10/32](#) takes precedence)}
- 10/28 . . characterised by the composition of the substrate
- 10/30 . . characterised by the composition of the
intermediate layers {, e.g. seed, buffer, template,
diffusion preventing, cap layers ([H01F 10/06](#) and
[H01F 10/32](#) take precedence)}
- 10/32 . Spin-exchange-coupled multilayers, e.g.
nanostructured superlattices {(applying spin-
exchange-coupled multilayers to substrates
[H01F 41/302](#))}
- 10/3204 . . {Exchange coupling of amorphous multilayers}
- 10/3209 . . {Exchange coupling of garnet multilayers}
- 10/3213 . . {Exchange coupling of magnetic semiconductor
multilayers, e.g. MnSe/ZnSe superlattices
(semiconductor materials for use in
semiconductor devices [H01L 29/12](#))}
- 10/3218 . . {Exchange coupling of magnetic films via an
antiferromagnetic interface ([H01F 10/3268](#) takes
precedence)}
- 10/3222 . . {Exchange coupled hard/soft multilayers, e.g.
CoPt/Co or NiFe/CoSm (nanocomposite spring
magnets [H01F 1/0579](#))}
- 10/3227 . . {Exchange coupling via one or more
magnetisable ultrathin or granular films}
- 10/3231 . . . {via a non-magnetic spacer}
- 10/3236 {made of a noble metal, e.g.(Co/Pt) n
multilayers having perpendicular anisotropy
([H01F 10/3286](#) takes precedence)}
- 10/324 . . {Exchange coupling of magnetic film pairs via a
very thin non-magnetic spacer, e.g. by exchange
with conduction electrons of the spacer}
- 10/3245 . . . {the spacer being superconductive}
- 10/325 . . . {the spacer being noble metal}
- 10/3254 . . . {the spacer being semiconducting or insulating,
e.g. for spin tunnel junction [STJ]}
- 10/3259 {Spin-exchange-coupled multilayers
comprising at least a nanooxide layer [NOL],
e.g. with a NOL spacer}
- 10/3263 . . . {the exchange coupling being symmetric, e.g.
for dual spin valve, e.g. NiO/Co/Cu/Co/Cu/Co/
NiO}
- 10/3268 . . . {the exchange coupling being asymmetric,
e.g. by use of additional pinning, by using
antiferromagnetic or ferromagnetic coupling
interface, i.e. so-called spin-valve [SV]
structure, e.g. NiFe/Cu/NiFe/FeMn}
- 10/3272 {by use of anti-parallel coupled [APC]
ferromagnetic layers, e.g. artificial
ferrimagnets [AFI], artificial [AAF] or
synthetic [SAF] anti-ferromagnets}
- 10/3277 {by use of artificial ferrimagnets [AFI]
only}
- 10/3281 {only by use of asymmetry of the magnetic
film pair itself, i.e. so-called pseudospin
valve [PSV] structure, e.g. NiFe/Cu/Co}
- 10/3286 . . . {Spin-exchange coupled multilayers having
at least one layer with perpendicular magnetic
anisotropy}
- 10/329 . . . {Spin-exchange coupled multilayers wherein
the magnetisation of the free layer is switched
by a spin-polarised current, e.g. spin torque
effect}
- 10/3295 . . . {Spin-exchange coupled multilayers wherein
the magnetic pinned or free layers are
laminated without anti-parallel coupling within
the pinned and free layers}
- 13/00 Apparatus or processes for magnetising or
demagnetising** ({devices for holding workpieces
using magnetic or electric force acting directly
on the workpieces [B23Q 3/15](#) ; for degaussing
ships [B63G 9/06](#); for clocks or watches [G04D 9/00](#);
{recording or erasing of information on magnetic
record carriers [G11B 5/00](#) ; demagnetising
arrangements for colour television [H04N 9/29](#))}
- 13/003 . {Methods and devices for magnetising permanent
magnets (permanent magnets [H01F 7/02](#))}
- 13/006 . {Methods and devices for demagnetising of
magnetic bodies, e.g. workpieces, sheet material
(for erasing of information on magnetic record
carriers [G11B 5/00](#))}
- 17/00 Fixed inductances of the signal type** (coils in
general [H01F 5/00](#) {inductors without a potential-
jump or surface barrier specially adapted for
integrated circuits, details thereof and multistep
manufacturing processes therefor [H01L 28/10](#)})
- 17/0006 . {Printed inductances (printed coils for dynamo-
electric machines [H02K 3/26](#); printed circuits
[H05K](#))}
- 17/0013 . . {with stacked layers}
- 2017/002 . . . {Details of via holes for interconnecting the
layers}
- 2017/0026 . . . {Multilayer LC-filter}
- 17/0033 . . {with the coil helically wound around a magnetic
core}
- 2017/004 . . {with the coil helically wound around an axis
without a core}
- 2017/0046 . . {with a conductive path having a bridge}
- 2017/0053 . . {with means to reduce eddy currents}
- 2017/006 . . {flexible printed inductors}
- 2017/0066 . . {with a magnetic layer}
- 2017/0073 . . {with a special conductive pattern, e.g. flat spiral}

2017/008	. . {Electric or magnetic shielding of printed inductances}	27/006	. {with special arrangement or spacing of turns of the winding(s), e.g. to produce desired self-resonance}
2017/0086	. . {on semiconductor substrate (inductors for integrated circuits H01L 28/10)}	27/008	. {with temperature compensation}
2017/0093	. {Common mode choke coil}	27/02	. Casings
17/02	. without magnetic core	27/022	. . {Encapsulation}
17/03	. . with ceramic former	27/025	. . {Constructional details relating to cooling}
17/04	. with magnetic core	27/027	. . {specially adapted for combination of signal type inductors or transformers with electronic circuits, e.g. mounting on printed circuit boards}
17/041	. . {Means for preventing rotation or displacement of the core}	27/04	. . Leading of conductors or axles through casings, e.g. for tap-changing arrangements
17/043	. . {with two, usually identical or nearly identical parts enclosing completely the coil (pot cores)}	27/06	. Mounting, supporting or suspending transformers, reactors or choke coils {not being of the signal type}
17/045	. . {with core of cylindric geometry and coil wound along its longitudinal axis, i.e. rod or drum core}	2027/065	. . {Mounting on printed circuit boards}
2017/046	. . . {helical coil made of flat wire, e.g. with smaller extension of wire cross section in the direction of the longitudinal axis}	27/08	. Cooling (heat-transfer elements F28F); Ventilating (structural details of casings H01F 27/02)
2017/048	. . {with encapsulating core, e.g. made of resin and magnetic powder}	27/085	. . {Cooling by ambient air}
17/06	. . with core substantially closed in itself, e.g. toroid	27/10	. . Liquid cooling
17/062	. . . {Toroidal core with turns of coil around it}	27/105	. . . {Cooling by special liquid or by liquid of particular composition}
2017/065	. . . {Core mounted around conductor to absorb noise, e.g. EMI filter}	27/12	. . . Oil cooling
2017/067	. . . {Core with two or more holes to lead through conductor}	27/125	. . . . {Cooling by synthetic insulating and incombustible liquid}
17/08	. . . Loading coils for telecommunication circuits	27/14	. . . . Expansion chambers; Oil conservators; Gas cushions; Arrangements for purifying, drying, or filling
19/00	Fixed transformers or mutual inductances of the signal type (H01F 36/00 takes precedence)	27/16	. . . Water cooling
19/02	. Audio-frequency transformers or mutual inductances, i.e. not suitable for handling frequencies considerably beyond the audio range	27/18	. . . by evaporating liquids
19/04	. Transformers or mutual inductances suitable for handling frequencies considerably beyond the audio range (resonant circuits H03H)	27/20	. . Cooling by special gases or non-ambient air
19/06	. . Broad-band transformers, e.g. suitable for handling frequencies well down into the audio range	27/22	. . Cooling by heat conduction through solid or powdered fillings
19/08	. . Transformers having magnetic bias, e.g. for handling pulses	27/23	. Corrosion protection
2019/085	. . . {Transformer for galvanic isolation}	27/24	. Magnetic cores
21/00	Variable inductances or transformers of the signal type (H01F 36/00 takes precedence)	27/245	. . made from sheets, e.g. grain-oriented (H01F 27/26 takes precedence)
21/005	. {Inductances without magnetic core}	27/2455	. . . {using bent laminations}
21/02	. continuously variable, e.g. variometers	27/25	. . made from strips or ribbons (H01F 27/26 takes precedence)
21/04	. . by relative movement of turns or parts of windings	27/255	. . made from particles (H01F 27/26 takes precedence)
21/06	. . by movement of core or part of core relative to the windings as a whole	27/26	. . Fastening parts of the core together; Fastening or mounting the core on casing or support (on coil H01F 27/30)
21/065	. . . {Measures for obtaining a desired relation between the position of the core and the inductance}	27/263	. . . {Fastening parts of the core together}
21/08	. . by varying the permeability of the core, e.g. by varying magnetic bias	27/266	. . . {Fastening or mounting the core on casing or support (on coil H01F 27/30)}
21/10	. . by means of a movable shield	27/28	. Coils; Windings; Conductive connections
21/12	. discontinuously variable, e.g. tapped	27/2804	. . {Printed windings}
2021/125	. . {Printed variable inductor with taps, e.g. for VCO}	2027/2809	. . . {on stacked layers}
27/00	Details of transformers or inductances, in general	2027/2814	. . . {with only part of the coil or of the winding in the printed circuit board, e.g. the remaining coil or winding sections can be made of wires or sheets}
27/002	. {Arrangements provided on the transformer facilitating its transport}	2027/2819	. . . {Planar transformers with printed windings, e.g. surrounded by two cores and to be mounted on printed circuit}
27/004	. {Arrangements for interchanging inductances, transformers or coils thereof}	27/2823	. . {Wires (H01F 27/2866 takes precedence)}
		27/2828	. . . {Construction of conductive connections, of leads}
		2027/2833	. . . {using coaxial cable as wire}
		2027/2838	. . . {using transposed wires}

2027/2842	. . . {Wire coils wound in conical zigzag to reduce voltage between winding turns}	27/346	. . {Preventing or reducing leakage fields (using magnetic shields H01F 27/36 ; using auxiliary windings H01F 27/38)}
27/2847	. . {Sheets; Strips (H01F 27/2866 takes precedence)}	2027/348	. . {Preventing eddy currents}
27/2852	. . . {Construction of conductive connections, of leads}	27/36	. . Electric or magnetic shields or screens (movable for varying inductance H01F 21/10)
2027/2857	. . . {Coil formed from wound foil conductor}	WARNING	
2027/2861	. . . {Coil formed by folding a blank}	Group H01F 27/36 is impacted by reclassification into groups H01F 27/361 , H01F 27/363 and H01F 27/366 .	
27/2866	. . {Combination of wires and sheets}	All subgroups listed in this Warning should be considered in order to perform a complete search.	
27/2871	. . {Pancake coils}	27/361	. . . {made of combinations of electrically conductive material and ferromagnetic material}
27/2876	. . {Cooling (cooling transformers and inductances in general H01F 27/08)}	WARNING	
27/288	. . {Shielding}	Group H01F 27/361 is incomplete pending reclassification of documents from group H01F 27/36 .	
27/2885	. . . {with shields or electrodes (shields or electrodes for pancake coils H01F 27/2871 ; construction of electric or magnetic shields or screens H01F 27/36)}	Groups H01F 27/36 and H01F 27/361 should be considered in order to perform a complete search.	
27/289	. . . {with auxiliary windings (for pancake coils H01F 27/2871)}	27/363	. . . {made of electrically conductive material}
27/2895	. . {Windings disposed upon ring cores}	WARNING	
27/29	. . Terminals; Tapping arrangements {for signal inductances}	Group H01F 27/363 is incomplete pending reclassification of documents from group H01F 27/36 .	
27/292	. . . {Surface mounted devices}	Groups H01F 27/36 and H01F 27/361 should be considered in order to perform a complete search.	
2027/295	. . . . {with flexible terminals}	27/366	. . . {made of ferromagnetic material}
2027/297	. . . {with pin-like terminal to be inserted in hole of printed path}	WARNING	
27/30	. . Fastening or clamping coils, windings, or parts thereof together; Fastening or mounting coils or windings on core, casing, or other support	Group H01F 27/366 is incomplete pending reclassification of documents from group H01F 27/36 .	
27/303	. . . {Clamping coils, windings or parts thereof together}	Groups H01F 27/36 and H01F 27/363 should be considered in order to perform a complete search.	
27/306	. . . {Fastening or mounting coils or windings on core, casing or other support}	27/38	. . Auxiliary core members; Auxiliary coils or windings
27/32	. . Insulating of coils, windings, or parts thereof	27/385	. . . {for reducing harmonics}
27/321	. . . {using a fluid for insulating purposes only}	27/40	. . Structural association with built-in electric component, e.g. fuse
27/322	. . . {the insulation forming channels for circulation of the fluid}	27/402	. . {Association of measuring or protective means}
27/323	. . . {Insulation between winding turns, between winding layers}	2027/404	. . . {Protective devices specially adapted for fluid filled transformers}
27/324	. . . {Insulation between coil and core, between different winding sections, around the coil; Other insulation structures}	2027/406	. . . {Temperature sensor or protection}
27/325	. . . . {Coil bobbins (formers for coils in general H01F 5/02)}	2027/408	. . {Association with diode or rectifier}
27/326	. . . . {specifically adapted for discharge lamp ballasts}	27/42	. . Circuits specially adapted for the purpose of modifying, or compensating for, electric characteristics of transformers, reactors, or choke coils (circuits for controlling transformers, reactors or choke coils, for the purpose of obtaining a desired output H02P 13/00 ; impedance networks H03H)
27/327	. . . {Encapsulating or impregnating (encapsulating coil and core H01F 27/022)}	27/422	. . {for instrument transformers}
2027/328	. . . . {Dry-type transformer with encapsulated foil winding, e.g. windings coaxially arranged on core legs with spacers for cooling and with three phases}	27/425	. . . {for voltage transformers}
2027/329	. . . {Insulation with semiconducting layer, e.g. to reduce corona effect}		
27/33	. Arrangements for noise damping		
27/34	. Special means for preventing or reducing unwanted electric or magnetic effects, e.g. no-load losses, reactive currents, harmonics, oscillations, leakage fields		
27/341	. . {Preventing or reducing no-load losses or reactive currents}		
27/343	. . {Preventing or reducing surge voltages; oscillations}		
27/345	. . . {using auxiliary conductors}		

27/427	. . . {for current transformers}	38/06	. . for changing the wave shape
29/00	Variable transformers or inductances not covered by group H01F 21/00 {(tap change devices H01H 9/0005)}	38/08	. High-leakage transformers or inductances
29/02	. with tappings on coil or winding; with provision for rearrangement or interconnection of windings	38/085	. . {Welding transformers}
29/025	. . {Constructional details of transformers or reactors with tapping on coil or windings}	38/10	. . Ballasts, e.g. for discharge lamps
29/04	. . having provision for tap-changing without interrupting the load current	38/12	. Ignition, e.g. for IC engines
29/06	. with current collector gliding or rolling on or along winding	2038/122	. . {with rod-shaped core}
29/08	. with core, coil, winding, or shield movable to offset variation of voltage or phase shift, e.g. induction regulators	2038/125	. . {with oil insulation}
29/10	. . having movable part of magnetic circuit {(high leakage transformers H01F 38/08 ; dynamo-electric machines with movable part of magnetic circuit H02K 23/44 , H02K 23/48)}	2038/127	. . {with magnetic circuit including permanent magnet}
29/12	. . having movable coil, winding, or part thereof; having movable shield	38/14	. Inductive couplings {(for wireless supply or distribution of electric power using inductive coupling H02J 50/10)}
29/14	. with variable magnetic bias {(amplitude modulation by means of variable impedance element H03C 1/08) ; magnetic amplifiers H03F ; {circuits for automatic telephonic communication H04M 3/00)}	2038/143	. . {for signals}
2029/143	. . {with control winding for generating magnetic bias}	2038/146	. . {in combination with capacitive coupling}
29/146	. . {Constructional details}	38/16	. Cascade transformers, e.g. for use with extra high tension
30/00	Fixed transformers not covered by group H01F 19/00	38/18	. Rotary transformers
30/02	. Auto-transformers	38/20	. Instruments transformers
30/04	. having two or more secondary windings, each supplying a separate load, e.g. for radio set power supplies	38/22	. . for single phase ac
30/06	. characterised by the structure	38/24	. . . Voltage transformers
30/08	. . without magnetic core	38/26	. . . . Constructions
30/10	. . Single-phase transformers (H01F 30/16 takes precedence)	38/28	. . . . Current transformers
30/12	. . Two-phase, three-phase or polyphase transformers	38/30	. . . . Constructions
30/14	. . . for changing the number of phases	2038/305	. . . . . {with toroidal magnetic core}
30/16	. . Toroidal transformers	38/32	. . . . . Circuit arrangements
36/00	Transformers with superconductive windings or with windings operating at cryogenic temperature (superconducting magnets or superconducting coils H01F 6/00)	38/34	. . . . Combined voltage and current transformers
37/00	Fixed inductances not covered by group H01F 17/00	38/36	. . . . Constructions
37/005	. {without magnetic core}	38/38	. . for polyphase ac
38/00	Adaptations of transformers or inductances for specific applications or functions	38/40	. . for dc
2038/003	. {High frequency transformer for microwave oven}	38/42	. Flyback transformers
2038/006	. {matrix transformer consisting of several interconnected individual transformers working as a whole}	2038/423	. . {with adjusting potentiometers}
38/02	. for non-linear operation	2038/426	. . {with gap in transformer core}
38/023	. . {of inductances}	41/00	Apparatus or processes specially adapted for manufacturing or assembling magnets, inductances or transformers; Apparatus or processes specially adapted for manufacturing materials characterised by their magnetic properties
2038/026	. . . {non-linear inductive arrangements for converters, e.g. with additional windings}		NOTE
38/04	. . for frequency changing		Group H01F 41/30 takes precedence over groups H01F 41/16 - H01F 41/24 {, and over group H01F 41/32 .
			This Note corresponds to IPC Note (1) relating to H01F 41/16 - H01F 41/24 , H01F 41/32 .)
		41/005	. {Impregnating or encapsulating (insulating of windings H01F 41/12)}
		41/02	. for manufacturing cores, coils, or magnets (H01F 41/14 takes precedence; for dynamo-electric machines H02K 15/00)
		41/0206	. . {Manufacturing of magnetic cores by mechanical means (magnetic cores per se H01F 27/24)}
		41/0213	. . . {Manufacturing of magnetic circuits made from strip(s) or ribbon(s) (magnetic cores made by winding a ribbon H01F 27/25)}
		41/022	. . . . {by winding the strips or ribbons around a coil}
		41/0226	. . . . {from amorphous ribbons}
		41/0233	. . . {Manufacturing of magnetic circuits made from sheets (magnetic cores made from sheets H01F 27/245 ; soft magnetic alloys in the form of sheets H01F 1/16)}

41/024	. . . . {Manufacturing of magnetic circuits made from deformed sheets (magnetic cores made from deformed sheets H01F 27/2455)}	41/08	. . . . Winding conductors onto closed formers or cores, e.g. threading conductors through toroidal cores
41/0246	. . . {Manufacturing of magnetic circuits by moulding or by pressing powder (magnetic cores made by moulding or by pressing powder H01F 27/255 ; soft magnetic particles H01F 1/20 , H01F 1/36)}	41/082	. . . . Devices for guiding or positioning the winding material on the former
41/0253	. . {for manufacturing permanent magnets}	41/084	. . . . . for forming pancake coils
41/026	. . . {protecting methods against environmental influences, e.g. oxygen, by surface treatment (magnetic particles with skin H01F 1/061 , H01F 1/09 , H01F 1/24 , H01F 1/33 and G11B 5/706)}	41/086	. . . . . in a special configuration on the former, e.g. orthocyclic coils or open mesh coils
41/0266	. . . {Moulding; Pressing (H01F 41/0273 takes precedence; hard magnetic particles H01F 1/06 , H01F 1/11)}	41/088	. . . . . using revolving flyers
41/0273	. . . {Imparting anisotropy (methods and devices for magnetising permanent magnets H01F 13/003)}	41/09	. . . . Winding machines having two or more work holders or formers
41/028	. . . . {Radial anisotropy (for rotor or stator bodies H02K 15/02)}	41/092	. . . . . Turrets; Turntables
41/0286	. . . {Trimming}	41/094	. . . . Tensioning or braking devices
41/0293	. . . {diffusion of rare earth elements, e.g. Tb, Dy or Ho, into permanent magnets}	41/096	. . . . Dispensing or feeding devices
41/04	. . for manufacturing coils {(coils for transformer or inductances H01F 27/28)}	41/098	. . . . Mandrels; Formers
41/041	. . . {Printed circuit coils (apparatus or processes for manufacturing printed circuits in general H05K 3/00)}	41/10	. . . Connecting leads to windings (making electric connections in general H01R 43/00)
41/042	. . . . {by thin film techniques}	41/12	. . . Insulating of windings ({impregnating or encapsulating of transformers H01F 41/005 }; of conductors in general H01B 13/06)
41/043	. . . . {by thick film techniques}	41/122	. . . . {Insulating between turns or between winding layers}
41/045	. . . . {Trimming}	41/125	. . . . {Other insulating structures; Insulating between coil and core, between different winding sections, around the coil}
41/046	. . . . {structurally combined with ferromagnetic material}	41/127	. . . . {Encapsulating or impregnating (encapsulating coil and core H01F 41/005)}
41/047	. . . . {structurally combined with superconductive material}	41/14	. for applying magnetic films to substrates
41/048	. . . {Superconductive coils}	41/16	. . the magnetic material being applied in the form of particles, e.g. by serigraphy {, to form thick magnetic films or precursors thereof} (H01F 41/18 {- H01F 41/24 } take precedence)
41/06	. . . Coil winding	41/18	. . by cathode sputtering
41/061	. . . . Winding flat conductive wires or sheets	41/183	. . . {Sputtering targets therefor}
41/063	. . . . . with insulation	41/186	. . . {for applying a magnetic garnet film (magnetic garnet materials H01F 1/346 ; magnetic garnet films H01F 10/24)}
41/064	. . . . Winding non-flat conductive wires, e.g. rods, cables or cords	41/20	. . by evaporation
41/066	. . . . . with insulation	41/205	. . . {by laser ablation, e.g. pulsed laser deposition [PLD]}
41/068	. . . . . in the form of strip material	41/22	. . Heat treatment; Thermal decomposition; Chemical vapour deposition
41/069	. . . . . Winding two or more wires, e.g. bifilar winding	41/24	. . from liquids
41/07	. . . . . Twisting	41/26	. . . using electric currents {, e.g. electroplating}
41/071	. . . . Winding coils of special form (winding conductors onto closed formers or cores H01F 41/08)	41/28	. . . by liquid phase epitaxy
2041/0711	. . . . . {Winding saddle or deflection coils}	41/30	. . for applying nanostructures, e.g. by molecular beam epitaxy [MBE]
41/073	. . . . . Winding onto elongate formers	41/301	. . . {for applying ultrathin or granular layers (ultrathin or granular layers H01F 10/007)}
41/074	. . . . . Winding flat coils	41/302	. . . {for applying spin-exchange-coupled multilayers, e.g. nanostructured superlattices (spin-exchange-coupled multilayers H01F 10/32)}
41/076	. . . . Forming taps or terminals while winding, e.g. by wrapping or soldering the wire onto pins, or by directly forming terminals from the wire	41/303	. . . . {with exchange coupling adjustment of magnetic film pairs, e.g. interface modifications by reduction, oxidation}
41/077	. . . . Deforming the cross section or shape of the winding material while winding	41/304	. . . . . {using temporary decoupling, e.g. involving blocking, Néel or Curie temperature transitions by heat treatment in presence/absence of a magnetic field}
41/079 Measuring electrical characteristics while winding	41/305 {applying the spacer or adjusting its interface, e.g. in order to enable particular effect different from exchange coupling}
		41/306 {conductive spacer}

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- 41/307 {insulating or semiconductive spacer}
- 41/308 {lift-off processes, e.g. ion milling, for trimming or patterning}
- 41/309 {electroless or electrodeposition processes from plating solution}
- 41/32 for applying conductive, insulating or magnetic material on a magnetic film {, specially adapted for a thin magnetic film}
- 41/325 {applying a noble metal capping on a spin-exchange-coupled multilayer, e.g. spin filter deposition}
- 41/34 in patterns, e.g. by lithography