

**CPC****COOPERATIVE PATENT CLASSIFICATION****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.

**Guidance heading:****H01F 1/00**

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

**H01F 1/0009**

- . { Antiferromagnetic materials, i.e. materials exhibiting a Néel transition temperature ( [H01F 1/0036](#) takes precedence ) }

**WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 1/00](#) - [H01F 1/44](#) R

**H01F 1/0018**

- . { Diamagnetic or paramagnetic materials, i.e. materials with low susceptibility and no hysteresis ( [H01F 1/0036](#) takes precedence ) }

**H01F 1/0027**

- . { Thick magnetic films ( forming thick magnetic films [H01F 41/16](#) ; magnetic record carriers [G11B 5/70](#) ) }

**NOTE**

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

**H01F 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](#) ) }

**H01F 1/0045**

- .. { Zero dimensional, e.g. nanoparticles, soft nanoparticles for medical/biological use ( preparation of fullerenes in general [C01B 31/0206](#) ) }

**H01F 1/0054**

- ... { Coated nanoparticles, e.g. nanoparticles coated with organic surfactant }

**H01F 1/0063**

- ... { in a non-magnetic matrix, e.g. granular solids ( granular films [H01F 10/007](#) ) }

**H01F 1/0072**

- .. { one dimensional, i.e. linear or dendritic nanostructures }

H01F 1/0081	...	{ in a non-magnetic matrix, e.g. Fe-nanowires in a nanoporous membrane }
H01F 1/009	..	{ bidimensional, e.g. nanoscale period nanomagnet arrays ( <a href="#">H01F 10/007</a> takes precedence ) }
H01F 1/01	.	of inorganic materials ( <a href="#">H01F 1/44</a> takes precedence )
H01F 1/012	..	{ adapted for magnetic entropy change by magnetocaloric effect, e.g. used as magnetic refrigerating material ( refrigeration systems using magnetic effects <a href="#">F25B 21/00</a> ) }
H01F 1/015	...	{ Metals or alloys }
H01F 1/017	...	{ Compounds }
H01F 1/03	..	characterised by their coercivity { ( <a href="#">H01F 1/40</a> takes precedence ) }
H01F 1/0302	...	{ characterised by unspecified or heterogeneous hardness or specially adapted for magnetic hardness transitions }
H01F 1/0304	....	{ adapted for large Barkhausen jumps or domain wall rotations, e.g. WIEGAND or MATTEUCCI effect ( <a href="#">H01F 1/143</a> and <a href="#">H01F 1/15391</a> take precedence ) }
H01F 1/0306	....	{ Metals or alloys, e.g. LAVES phase alloys of the MgCu <sub>2</sub> -type ( <a href="#">H01F 1/0304</a> takes precedence ) }
H01F 1/0308	.....	{ with magnetic shape memory (MSM), i.e. with lattice transformations driven by a magnetic field, e.g. Heusler alloys }
H01F 1/0311	....	{ Compounds ( <a href="#">H01F 1/0304</a> takes precedence ) }
H01F 1/0313	.....	{ Oxidic compounds }
H01F 1/0315	.....	{ Ferrites }
H01F 1/0317	.....	{ Manganites }
H01F 1/032	...	of hard-magnetic materials
H01F 1/04	....	Metals or alloys
H01F 1/047	.....	Alloys characterised by their composition

**NOTE**

In groups [H01F 1/053](#) to [H01F 1/059](#) , an alloy is classified in the last appropriate place

H01F 1/053	.....	containing rare earth metals
H01F 1/0533	.....	{ in a bonding agent }
H01F 1/0536	.....	{ sintered }
H01F 1/055	.....	and magnetic transition metals, e.g. SmCo <sub>5</sub>
H01F 1/0551	.....	{ in the form of particles, e.g. rapid quenched powders or ribbon flakes }
H01F 1/0552	.....	{ with a protective layer }
H01F 1/0553	.....	{ obtained by reduction or by hydrogen decrepitation or embrittlement }
H01F 1/0555	.....	{ pressed, sintered or bonded together }
H01F 1/0556	.....	{ pressed }
H01F 1/0557	.....	{ sintered }
H01F 1/0558	.....	{ bonded together }
H01F 1/057	.....	and IIIa elements, e.g. Nd <sub>2</sub> Fe <sub>14</sub> B

H01F 1/0571	.....	{ in the form of particles, e.g. rapid quenched powders or ribbon flakes }
H01F 1/0572	.....	{ with a protective layer }
H01F 1/0573	.....	{ obtained by reduction or by hydrogen decrepitation or embrittlement }
H01F 1/0574	.....	{ obtained by liquid dynamic compaction }
H01F 1/0575	.....	{ pressed, sintered or bonded together }
H01F 1/0576	.....	{ pressed, e.g. hot working }
H01F 1/0577	.....	{ sintered }
H01F 1/0578	.....	{ bonded together }
H01F 1/0579	.....	{ with exchange spin coupling between hard and soft nanophases, e.g. nanocomposite spring magnets }
H01F 1/058	.....	and IVa elements, e.g. Gd <sub>2</sub> Fe <sub>14</sub> C
H01F 1/059	.....	and Va elements, e.g. Sm <sub>2</sub> Fe <sub>17</sub> N <sub>2</sub>
H01F 1/0593	.....	{ of tetragonal ThMn <sub>12</sub> -structure }
H01F 1/0596	.....	{ of rhombic or rhombohedral Th <sub>2</sub> Zn <sub>17</sub> structure or hexagonal Th <sub>2</sub> Ni <sub>17</sub> structure }
H01F 1/06	.....	in the form of particles, e.g. powder ( <a href="#">H01F 1/047</a> takes precedence; { record carriers <a href="#">G11B 5/70605</a> } )
H01F 1/061	.....	{ with a protective layer }
H01F 1/063	.....	{ with a non magnetic core }
H01F 1/065	.....	{ obtained by a reduction }
H01F 1/066	.....	{ obtained by liquid dynamic compaction }
H01F 1/068	.....	{ having a L10 crystallographic structure, e.g. [Co,Fe] [Pt,Pd] (nano)particles }

### **WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 1/06](#) - [H01F 1/06 E](#)

H01F 1/08	.....	pressed, sintered, or bound together
H01F 1/083	.....	{ in a bonding agent }
H01F 1/086	.....	{ sintered }
H01F 1/09	....	Mixtures of metallic and non-metallic particles ; Metallic particles having oxide skin
H01F 1/10	....	Non-metallic substances, e.g. ferrites { e.g. [(Ba,Sr)O(Fe <sub>2</sub> O <sub>3</sub> ) <sub>6</sub> ] ferrites with hexagonal structure }
H01F 1/11	.....	in the form of particles { ( for magnetic record carriers <a href="#">G11B 5/70626</a> ) }
H01F 1/111	.....	{ with a non-magnetic core }
H01F 1/112	.....	{ with a skin ( <a href="#">H01F 1/113</a> takes precedence ) }
H01F 1/113	.....	in a bonding agent
H01F 1/117	.....	Flexible bodies
H01F 1/12	...	of soft-magnetic materials
H01F 1/14	....	Metals or alloys
H01F 1/143	.....	{ in the form of wires ( <a href="#">H01F 1/147</a> takes precedence ) }

H01F 1/147	.....	Alloys characterised by their composition { ( treatment thereof for enhancing their electromagnetic properties <a href="#">C21D 8/12</a> ) }
<b>NOTE</b>		
In groups <a href="#">H01F 1/14708</a> to <a href="#">H01F 1/15391</a> , an alloy is classified in the last appropriate place		
H01F 1/14708	.....	{ Fe-Ni based alloys ( pure Fe or Ni <a href="#">H01F 1/14</a> , <a href="#">H01F 1/16</a> or <a href="#">H01F 1/20</a> ) }
H01F 1/14716	.....	{ in the form of sheets }
H01F 1/14725	.....	{ with insulating coating }
H01F 1/14733	.....	{ in the form of particles }
H01F 1/14741	.....	{ pressed, sintered or bonded together }
H01F 1/1475	.....	{ the particles being insulated }
H01F 1/14758	.....	{ by macromolecular organic substances }
H01F 1/14766	.....	{ Fe-Si based alloys }
H01F 1/14775	.....	{ in the form of sheets }
H01F 1/14783	.....	{ with insulating coating }
H01F 1/14791	.....	{ Fe-Si-Al based alloys, e.g. Sendust }
H01F 1/153	.....	Amorphous metallic alloys, e.g. glassy metals { ( making ferrous amorphous alloys <a href="#">C22C 33/003</a> ) }
H01F 1/15308	.....	{ based on Fe/Ni ( <a href="#">H01F 1/15325</a> takes precedence ) }
H01F 1/15316	.....	{ based on Co ( <a href="#">H01F 1/15325</a> takes precedence ) }
H01F 1/15325	.....	{ containing rare earths }
H01F 1/15333	.....	{ containing nanocrystallites, e.g. obtained by annealing }
H01F 1/15341	.....	{ Preparation processes therefor }
H01F 1/1535	.....	{ by powder metallurgy, e.g. spark erosion }
H01F 1/15358	.....	{ Making agglomerates therefrom, e.g. by pressing }
H01F 1/15366	.....	{ using a binder }
H01F 1/15375	.....	{ using polymers }
H01F 1/15383	.....	{ Applying coatings thereon ( <a href="#">H01F 1/15366</a> takes precedence ) }
H01F 1/15391	.....	{ Elongated structures, e.g. wires }
H01F 1/16	.....	in the form of sheets ( <a href="#">H01F 1/147</a> takes precedence )
H01F 1/18	.....	with insulating coating
H01F 1/20	.....	in the form of particles, e.g. powder ( <a href="#">H01F 1/147</a> takes precedence )
H01F 1/22	.....	pressed, sintered, or bound together
H01F 1/24	.....	the particles being insulated
H01F 1/26	.....	by macromolecular organic substances
H01F 1/28	.....	dispersed or suspended in a bonding agent
H01F 1/33	....	Mixtures of metallic and non-metallic particles ; Metallic particles having oxide skin
H01F 1/34	....	Non-metallic substances, e.g. ferrites
H01F 1/342	.....	{ Oxides ( <a href="#">H01F 1/36</a> and <a href="#">H01F 1/38</a> take precedence ) }
H01F 1/344	.....	{ Ferrites, e.g. having a cubic spinel structure (X <sub>2</sub> +O)(Y <sub>23</sub> +O <sub>3</sub> ); e.g.

		magnetite Fe <sub>3</sub> O <sub>4</sub> }
H01F 1/346	.....	{ Garnets, e.g. having a cubic nesosilicates-based structure [X <sub>2</sub> +3Y <sub>3</sub> +2 } [ ( TO4 ) 3] with T= Si, Al, Fe, Ga ( <a href="#">H01F 10/24</a> takes precedence; Faraday rotators <a href="#">G02F 1/09</a> ) ]
H01F 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 }
H01F 1/36	.....	in the form of particles { ( <a href="#">H01F 1/346</a> , <a href="#">H01F 1/348</a> and <a href="#">H01F 1/38</a> take precedence ) }
H01F 1/37	.....	in a bonding agent
H01F 1/375	.....	Flexible bodies
H01F 1/38	.....	amorphous, e.g. amorphous oxides
H01F 1/40	..	of magnetic semiconductor materials, e.g. CdCr <sub>2</sub> S <sub>4</sub> ( devices using galvano-magnetic or similar effects <a href="#">H01L 43/00</a> )
H01F 1/401	...	{ diluted }

**NOTE**

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

H01F 1/402	....	{ of II-VI type, e.g. Zn <sub>1-x</sub> Cr <sub>x</sub> Se }
H01F 1/404	....	{ of III-V type, e.g. In <sub>1-x</sub> Mn <sub>x</sub> As }
H01F 1/405	....	{ of IV type, e.g. Ge <sub>1-x</sub> Mn <sub>x</sub> }
H01F 1/407	....	{ Diluted non-magnetic ions in a magnetic cation-sublattice, e.g. perovskites, La <sub>1-x</sub> (Ba,Sr) <sub>x</sub> MnO <sub>3</sub> }
H01F 1/408	...	{ half-metallic, i.e. having only one electronic spin direction at the Fermi level, e.g. CrO <sub>2</sub> , Heusler alloys ( <a href="#">H01F 10/1936</a> takes precedence ) }
H01F 1/42	.	of organic or organo-metallic materials, { e.g. graphene } ( <a href="#">H01F 1/44</a> takes precedence )
H01F 1/44	.	of magnetic liquids, e.g. ferrofluids ( particles in a bonding agent <a href="#">H01F 1/28</a> , <a href="#">H01F 1/36</a> , { <a href="#">H01F 1/37</a> } )
H01F 1/442	..	{ the magnetic component being a metal or alloy, e.g. Fe ( <a href="#">H01F 1/447</a> takes precedence ) }
H01F 1/445	..	{ the magnetic component being a compound, e.g. Fe <sub>3</sub> O <sub>4</sub> ( <a href="#">H01F 1/447</a> takes precedence ) }
H01F 1/447	..	{ characterised by magnetoviscosity, e.g. magnetorheological, magnetorheotropic, magnetodilatant liquids ( electrorheological fluids <a href="#">C10M 171/001</a> ) }

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

H01F 3/02	.	made from sheets
H01F 3/04	.	made from strips or ribbons
H01F 3/06	.	made from wires
H01F 3/08	.	made from powder ( powder coatings on sheets <a href="#">H01F 3/02</a> ; on strips or ribbons

[3/04](#) ; on wires [H01F 3/06](#) )

- H01F 3/10 . Composite arrangements of magnetic circuits
- H01F 3/12 . . Magnetic shunt paths
- H01F 3/14 . . Constrictions ; Gaps, e.g. air-gaps ( in magnetic shunt paths [H01F 3/12](#) )

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

- H01F 5/003 . { [Printed circuit coils](#) }
- H01F 5/02 . wound on non-magnetic supports, e.g. formers
- H01F 5/04 . Arrangements of electric connections to coils, e.g. leads
- H01F 5/06 . Insulation of windings

**H01F 6/00** **Superconducting magnets ; Superconducting coils** { ( magnetic resonance assemblies using superconducting coil systems [G01R 33/3815](#) ) }

- H01F 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](#) ) }
- H01F 6/005 . { [Methods and means for increasing the stored energy in superconductive coils by increments](#) ( [flux pumps](#) ) }
- H01F 6/006 . { [Supplying energising or de-energising current; Flux pumps](#) }
- H01F 6/008 . . { [Electric circuit arrangements for energising superconductive electromagnets](#) }
- H01F 6/02 . Quenching ; Protection arrangements during quenching { ( [protection circuits](#) [H02H 7/001](#) ) }
- H01F 6/04 . Cooling
- H01F 6/06 . Coils, e.g. winding, insulating, terminating or casing arrangements therefor
- H01F 6/065 . . { [Feed-through bushings, terminals and joints](#) ( [leading of conductors or axles through casings of transformers](#) [H01F 27/04](#) ) }

**H01F 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](#) )

- H01F 7/02 . Permanent magnets { (PM) }

- H01F 7/0205 .. { Magnetic circuits with PM in general }
- H01F 7/021 ... { Construction of PM ( [H01F 7/0278](#) takes precedence; PM compositions [H01F 1/032](#) ) }
- H01F 7/0215 .... { Flexible forms, sheets }
- H01F 7/0221 ... { Mounting means for PM, supporting, coating, encapsulating PM }
- H01F 7/0226 ... { PM with variable field strength ( [H01F 7/0284](#) takes precedence ) }
- H01F 7/0231 .. { Magnetic circuits with PM for power or force generation }
- H01F 7/0236 ... { Magnetic suspension or levitation ( for vehicles [B60L 13/04](#) ; magnetic bearings [F16C 39/063](#) ) }
- H01F 7/0242 ... { Magnetic drives, magnetic coupling devices }
- H01F 7/0247 ... { Orientating, locating, transporting arrangements }
- H01F 7/0252 ... { PM holding devices ( [H01F 7/021](#) , [H01F 7/0215](#) , [H01F 7/0226](#) take precedence ) }
- H01F 7/0257 .... { Lifting, pick-up magnetic objects }
- H01F 7/0263 .... { Closures, bags, bands, engagement devices with male and female parts }
- H01F 7/0268 .... { Magnetic cylinders }
- H01F 7/0273 .. { Magnetic circuits with PM for magnetic field generation }
- H01F 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](#) ) }
- H01F 7/0284 .... { using a trimmable or adjustable magnetic circuit, e.g. for a symmetric dipole or quadrupole magnetic field }
- H01F 7/0289 ... { Transducers, loudspeakers, moving coil arrangements }
- H01F 7/0294 ... { Detection, inspection, magnetic treatment }
- H01F 7/04 .. Means for releasing the attractive force
  
- H01F 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](#) ; magnetically locked mine lamps [F21L 11/00](#) ; analysing materials by magnetic means [G01N 27/72](#) , [G01N 27/80](#) to [G01N 27/88](#) ; 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](#) ) }
- H01F 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](#) ) }
- H01F 7/066 .. { Electromagnets with movable winding }
- H01F 7/08 .. with armatures
- H01F 7/081 ... { Magnetic constructions }
- H01F 7/088 ... { provided with means for absorbing shocks }
- H01F 7/10 ... specially adapted for alternating current
- H01F 7/11 .... reducing or eliminating the effects of eddy currents
- H01F 7/12 .... having anti-chattering arrangements
- H01F 7/1205 ..... { having short-circuited conductors ( electromagnetic relays provided with short-circuited conducting sleeves [H01H 47/00](#) ) }
- H01F 7/121 ... Guiding or setting position of armatures, e.g. retaining armatures in their end



		position
H01F 7/122	....	by permanent magnets { ( <a href="#">H01F 7/1615</a> , <a href="#">H01F 7/1646</a> take precedence ) }
H01F 7/123	....	by ancillary coil
H01F 7/124	....	by mechanical latch, e.g. detent
H01F 7/126	...	Supporting or mounting
H01F 7/127	...	Assembling
H01F 7/128	...	Encapsulating, encasing or sealing
H01F 7/129	....	of armatures
H01F 7/13	...	characterised by pulling-force characteristics
H01F 7/14	...	Pivoting armatures ( <a href="#">H01F 7/17</a> takes precedence )
H01F 7/145	....	{ Rotary electromagnets with variable gap ( with fixed gap or torque motors <a href="#">H02K 26/00</a> ) }
H01F 7/16	...	Rectilinearly-movable armatures ( <a href="#">H01F 7/17</a> takes precedence )
H01F 7/1607	....	{ Armatures entering the winding }
H01F 7/1615	.....	{ Armatures or stationary parts of magnetic circuit having permanent magnet }
H01F 7/1623	.....	{ Armatures having T-form }
H01F 7/1638	....	{ Armatures not entering the winding }
H01F 7/1646	.....	{ Armatures or stationary parts of magnetic circuit having permanent magnet }
H01F 7/1653	....	{ Magnetic circuit having axially spaced pole-pieces }
H01F 7/17	...	Pivoting and rectilinearly-movable armatures
H01F 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
H01F 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 <a href="#">H01H 47/04</a> ; quick energising of electro-dynamic machines <a href="#">H02P 9/08</a> ; for quickly de-energising of dynamo-electric generators <a href="#">H02P 9/123</a> ) }
H01F 7/1811	.....	{ demagnetising upon switching off, removing residual magnetism }
H01F 7/1816	.....	{ making use of an energy accumulator ( for relays <a href="#">H01H 47/043</a> ) }
H01F 7/1827	.....	{ by changing number of serially-connected turns or windings ( for relays <a href="#">H01H 47/06</a> ) }
H01F 7/1833	.....	{ by changing number of parallel-connected turns or windings ( for relays <a href="#">H01H 47/08</a> ) }
H01F 7/1838	.....	{ by switching-in or -out impedance ( for relays <a href="#">H01H 47/10</a> ) }
H01F 7/1844	....	{ Monitoring or fail-safe circuits ( for relays <a href="#">H01H 47/002</a> ) }
H01F 7/1872	....	{ Bistable or bidirectional current devices ( relays <a href="#">H01H 47/226</a> ) }
H01F 7/1877	....	{ controlling a plurality of loads }
H01F 7/1883	....	{ by steepening leading and trailing edges of magnetisation pulse, e.g. printer drivers }
H01F 7/20	..	without armatures ( cores <a href="#">H01F 3/00</a> ; coils <a href="#">H01F 5/00</a> ; { shaping metal by applying magnetic forces <a href="#">B21D 26/14</a> ; analysing methods using magnetic fields <a href="#">G01N 24/06</a> ; electromagnets specially adapted for NMR applications <a href="#">G01R 33/381</a> } )



- H01F 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](#) ) }
- H01F 7/204 . . . . { Circuits for energising or de-energising }
- H01F 7/206 . . . { Electromagnets for lifting, handling or transporting of magnetic pieces or material ( electromagnets for guidance of vehicles, workpieces [B61B 31/08](#) , [B65G 21/2009](#) ; for magnetic suspension or levitation [H02N 15/00](#) ) }

**H01F 10/00** **Thin magnetic films, e.g. of one-domain structure** ( magnetic record carriers [G11B 5/00](#) ; thin-film magnetic stores [G11C](#) )

- H01F 10/002 . { Antiferromagnetic thin films, i.e. films exhibiting a Néel transition temperature ( [H01F 10/3218](#) and [H01F 10/3268](#) take precedence ) }

**WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 10/00](#) - [H01F 10/30](#)

- H01F 10/005 . { organic or organo-metallic films, e.g. monomolecular films obtained by Langmuir-Blodgett technique, graphene }
- H01F 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](#) ) }
- H01F 10/06 . characterised by the coupling or physical contact with connecting or interacting conductors
- H01F 10/08 . characterised by magnetic layers ( { [H01F 10/32](#) takes precedence } ; applying thin magnetic films to substrates [H01F 41/14](#) )
- H01F 10/10 . . characterised by the composition
- H01F 10/12 . . . being metal or alloys ( intermetallic compounds [H01F 10/18](#) )
- H01F 10/123 . . . . { having a L10 crystallographic structure, e.g. [Co,Fe] [Pt,Pd] thin films }

**WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 10/16](#)

- H01F 10/126 . . . . { containing rare earth metals ( [H01F 10/133](#) takes precedence ) }
- H01F 10/13 . . . . Amorphous metallic alloys, e.g. glassy metals { ( [H01F 10/3204](#) takes precedence ) }

**NOTE**

In this group, amorphous metallic alloys are classified in the last appropriate place

- H01F 10/131 . . . . { containing iron or nickel }
- H01F 10/132 . . . . { containing cobalt }
- H01F 10/133 . . . . { containing rare earth metals }

H01F 10/135	.....	{ containing transition metals }
H01F 10/136	.....	{ containing iron }
H01F 10/137	.....	{ containing cobalt }
H01F 10/138	.....	{ containing nanocrystallites, e.g. obtained by annealing }
H01F 10/14	....	containing iron or nickel ( { <a href="#">H01F 10/126</a> } , <a href="#">H01F 10/13</a> , <a href="#">H01F 10/16</a> take precedence )

**NOTE**

In this group, alloys containing iron or nickel are classified in the last appropriate place

H01F 10/142	.....	{ containing Si }
H01F 10/145	.....	{ containing Al, e.g. SENDUST }
H01F 10/147	.....	{ with lattice under strain, e.g. expanded by interstitial nitrogen ( <a href="#">H01F 10/26</a> to <a href="#">H01F 10/30</a> take precedence ) }
H01F 10/16	....	containing cobalt ( { <a href="#">H01F 10/126</a> } , <a href="#">H01F 10/13</a> take precedence )
H01F 10/18	...	being compounds
H01F 10/187	....	Amorphous compounds { ( <a href="#">H01F 10/3204</a> takes precedence ) }
H01F 10/193	....	Magnetic semiconductor compounds { ( in general <a href="#">H01F 1/40</a> ; multilayers, e.g. superlattices <a href="#">H01F 10/3213</a> ) }
H01F 10/1933	.....	{ Perovskites }

**WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 10/193](#)

H01F 10/1936	.....	{ Half-metallic, e.g. epitaxial CrO <sub>2</sub> or NiMnSb films }
H01F 10/20	....	Ferrites
H01F 10/205	.....	{ Hexagonal ferrites }
H01F 10/22	.....	Orthoferrites { e.g. RFeO <sub>3</sub> ( R= rare earth element ) with orthorhombic structure }
H01F 10/24	.....	Garnets { ( in general <a href="#">H01F 1/346</a> ; multilayers, e.g. superlattices <a href="#">H01F 10/3209</a> ; applying magnetic garnet films to substrates by sputtering <a href="#">H01F 41/186</a> ) }
H01F 10/245	.....	{ Modifications for enhancing interaction with electromagnetic wave energy }
H01F 10/26	.	characterised by the substrate or intermediate layers { ( <a href="#">H01F 10/06</a> and <a href="#">H01F 10/32</a> take precedence ) }
H01F 10/265	..	{ Magnetic multilayers non exchange-coupled ( <a href="#">H01F 10/32</a> takes precedence ) }

**WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 10/00](#) - [H01F 10/30](#)

H01F 10/28	..	characterised by the composition of the substrate
H01F 10/30	..	characterised by the composition of the intermediate layers { e.g. seed, buffer, template, diffusion preventing, cap layers ( <a href="#">H01F 10/06</a> and <a href="#">H01F 10/32</a> take

precedence ) }

- H01F 10/32 . Spin-exchange-coupled multilayers, e.g. nanostructured superlattices { ( applying spin-exchange-coupled multilayers to substrates [H01F 41/302](#) ) }
- H01F 10/3204 . . { Exchange coupling of amorphous multilayers }
- H01F 10/3209 . . { Exchange coupling of garnet multilayers }
- H01F 10/3213 . . { Exchange coupling of magnetic semiconductor multilayers, e.g. MnSe/ZnSe superlattices ( semiconductor materials for use in semiconductor devices [H01L 29/12](#) ) }
- H01F 10/3218 . . { Exchange coupling of magnetic films via an antiferromagnetic interface ( [H01F 10/3268](#) takes precedence ) }
- H01F 10/3222 . . { Exchange coupled hard/soft multilayers, e.g. CoPt/Co or NiFe/CoSm ( nanocomposite spring magnets [H01F 1/0579](#) ) }
- H01F 10/3227 . . { Exchange coupling via one or more magnetisable ultrathin or granular films }
- H01F 10/3231 . . . { via a non-magnetic spacer }
- H01F 10/3236 . . . . { made of a noble metal, e.g. ( Co/Pt )<sub>n</sub> multilayers having perpendicular anisotropy ( [H01F 10/3286](#) takes precedence ) }
- H01F 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 }
- H01F 10/3245 . . . { the spacer being superconductive }
- H01F 10/325 . . . { the spacer being noble metal }
- H01F 10/3254 . . . { the spacer being semiconducting or insulating, e.g. for spin tunnel junction (STJ) }
- H01F 10/3259 . . . . { Spin-exchange-coupled multilayers comprising at least a nano-oxide layer (NOL), e.g. with a NOL spacer }
- H01F 10/3263 . . . { the exchange coupling being symmetric, e.g. for dual spin valve, e.g. NiO/Co/Cu/Co/Cu/Co/NiO }
- H01F 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 }
- H01F 10/3272 . . . . { by use of anti-parallel coupled (APC) ferromagnetic layers, e.g. artificial ferrimagnets (AFI), artificial (AAF) or synthetic (SAF) anti-ferromagnets }
- H01F 10/3277 . . . . . { by use of artificial ferrimagnets (AFI) only }
- H01F 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 }
- H01F 10/3286 . . . { Spin-exchange coupled multilayers having at least one layer with perpendicular magnetic anisotropy }
- H01F 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 }
- H01F 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 }
  
- H01F 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](#) }
  
- H01F 13/003 . { Methods and devices for magnetising permanent magnets ( permanent magnets [H01F 7/02](#) ) }

- H01F 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](#) ) }
- H01F 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](#) } )
- H01F 17/0006 . { Printed inductances ( printed coils for dynamo-electric machines [H02K 3/26](#) ; printed circuits [H05K](#) ) }
- H01F 17/0013 . . { with stacked layers ( [H01F 27/2804](#) takes precedence ) }
- H01F 17/0033 . . { with the coil helically wound around a magnetic core }
- H01F 17/02 . without magnetic core
- H01F 17/03 . . with ceramic former
- H01F 17/04 . with magnetic core
- H01F 17/041 . . { Means for preventing rotation or displacement of the core }
- H01F 17/043 . . { with two, usually identical or nearly identical parts enclosing completely the coil ( pot cores ) }
- H01F 17/045 . . { with core of cylindric geometry and coil wound along its longitudinal axis, i.e. rod or drum core }
- H01F 17/06 . . with core substantially closed in itself, e.g. toroid
- H01F 17/062 . . . { Toroidal core with turns of coil around it }
- H01F 17/08 . . . Loading coils for telecommunication circuits
- H01F 19/00** **Fixed transformers or mutual inductances of the signal type** ( [H01F 36/00](#) takes precedence )
- H01F 19/02 . Audio-frequency transformers or mutual inductances, i.e. not suitable for handling frequencies considerably beyond the audio range
- H01F 19/04 . Transformers or mutual inductances suitable for handling frequencies considerably beyond the audio range ( resonant circuits [H03H](#) )
- H01F 19/06 . . Broad-band transformers, e.g. suitable for handling frequencies well down into the audio range
- H01F 19/08 . . Transformers having magnetic bias, e.g. for handling pulses
- H01F 21/00** **Variable inductances or transformers of the signal type** ( [H01F 36/00](#) takes precedence )
- H01F 21/005 . { Inductances without magnetic core }
- H01F 21/02 . continuously variable, e.g. variometers
- H01F 21/04 . . by relative movement of turns or parts of windings
- H01F 21/06 . . by movement of core or part of core relative to the windings as a whole
- H01F 21/065 . . . { Measures for obtaining a desired relation between the position of the core and the inductance }

- H01F 21/08 . . by varying the permeability of the core, e.g. by varying magnetic bias
- H01F 21/10 . . by means of a movable shield
- H01F 21/12 . discontinuously variable, e.g. tapped
- H01F 27/00 Details of transformers or inductances, in general**
- H01F 27/002 . { Arrangements provided on the transformer facilitating its transport }
- H01F 27/004 . { Arrangements for interchanging inductances, transformers or coils thereof }
- H01F 27/006 . { with special arrangement or spacing of turns of the winding(s), e.g. to produce desired self-resonance }
- H01F 27/008 . { with temperature compensation }
- H01F 27/02 . Casings
- H01F 27/022 . . { Encapsulation }
- H01F 27/025 . . { Constructional details relating to cooling }
- H01F 27/027 . . { specially adapted for combination of signal type inductors or transformers with electronic circuits, e.g. mounting on printed circuit boards }
- H01F 27/04 . . Leading of conductors or axles through casings, e.g. for tap-changing arrangements
- H01F 27/06 . Mounting, supporting or suspending transformers, reactors or choke coils { not being of the signal type }
- H01F 27/08 . Cooling ( [heat-transfer elements F28F](#) ) ; Ventilating ( [structural details of casings H01F 27/02](#) )
- H01F 27/085 . . { Cooling by ambient air }
- H01F 27/10 . . Liquid cooling
- H01F 27/105 . . . { Cooling by special liquid or by liquid of particular composition }
- H01F 27/12 . . . Oil cooling
- H01F 27/125 . . . . { Cooling by synthetic insulating and incombustible liquid }
- H01F 27/14 . . . . Expansion chambers ; Oil conservators ; Gas cushions ; Arrangements for purifying, drying, or filling
- H01F 27/16 . . . Water cooling
- H01F 27/18 . . . by evaporating liquids
- H01F 27/20 . . Cooling by special gases or non-ambient air
- H01F 27/22 . . Cooling by heat conduction through solid or powdered fillings
- H01F 27/23 . Corrosion protection
- H01F 27/24 . Magnetic cores
- H01F 27/245 . . made from sheets, e.g. grain-oriented ( [H01F 27/26 takes precedence](#) )
- H01F 27/2455 . . . { using bent laminations }
- H01F 27/25 . . made from strips or ribbons ( [H01F 27/26 takes precedence](#) )

- H01F 27/255 .. made from particles ( [H01F 27/26](#) takes precedence )
- H01F 27/26 .. Fastening parts of the core together ; Fastening or mounting the core on casing or support ( on coil [H01F 27/30](#) )
- H01F 27/263 ... { Fastening parts of the core together }
- H01F 27/266 ... { Fastening or mounting the core on casing or support ( on coil [H01F 27/30](#) ) }
- H01F 27/28 . Coils ; Windings ; Conductive connections
- H01F 27/2804 .. { Printed windings }
- H01F 27/2823 .. { Wires ( [H01F 27/2866](#) takes precedence ) }
- H01F 27/2828 ... { Construction of conductive connections, of leads }
- H01F 27/2847 .. { Sheets; Strips ( [H01F 27/2866](#) takes precedence ) }
- H01F 27/2852 ... { Construction of conductive connections, of leads }
- H01F 27/2866 .. { Combination of wires and sheets }
- H01F 27/2871 .. { Pancake coils }
- H01F 27/2876 .. { Cooling ( cooling transformers and inductances in general [H01F 27/08](#) ) }
- H01F 27/288 .. { Shielding }
- H01F 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](#) ) }
- H01F 27/289 ... { with auxiliary windings ( for pancake coils [H01F 27/2871](#) ) }
- H01F 27/2895 .. { Windings disposed upon ring cores }
- H01F 27/29 .. Terminals ; Tapping arrangements { for signal inductances }
- H01F 27/292 ... { Surface mounted devices }
- H01F 27/30 .. Fastening or clamping coils, windings, or parts thereof together ; Fastening or mounting coils or windings on core, casing, or other support
- H01F 27/303 ... { Clamping coils, windings or parts thereof together }
- H01F 27/306 ... { Fastening or mounting coils or windings on core, casing or other support }
- H01F 27/32 .. Insulating of coils, windings, or parts thereof
- H01F 27/321 ... { using a fluid for insulating purposes only }
- H01F 27/322 ... { the insulation forming channels for circulation of the fluid }
- H01F 27/323 ... { Insulation between winding turns, between winding layers }
- H01F 27/324 ... { Insulation between coil and core, between different winding sections, around the coil; Other insulation structures }
- H01F 27/325 .... { Coil bobbins ( formers for coils in general [H01F 5/02](#) ) }
- H01F 27/326 .... { specifically adapted for discharge lamp ballasts }
- H01F 27/327 ... { Encapsulating or impregnating ( encapsulating coil and core [H01F 27/022](#) ) }
- H01F 27/33 . Arrangements for noise damping
- H01F 27/34 . Special means for preventing or reducing unwanted electric or magnetic effects, e.g. no-load losses, reactive currents, harmonics, oscillations, leakage fields
- H01F 27/341 .. { Preventing or reducing no-load losses or reactive currents }
- H01F 27/343 .. { Preventing or reducing surge voltages; oscillations }
- H01F 27/345 ... { using auxiliary conductors }
- H01F 27/346 .. { Preventing or reducing leakage fields ( using magnetic shields [H01F 27/365](#) ;

- using auxiliary windings [H01F 27/38](#) ) }
- H01F 27/36 . . Electric or magnetic shields or screens ( movable for varying inductance [H01F 21/10](#) )
- H01F 27/362 . . . { Electric shields or screens }
- H01F 27/365 . . . { Magnetic shields or screens }
- H01F 27/367 . . . . { using non-magnetic screens }
- H01F 27/38 . . Auxiliary core members ; Auxiliary coils or windings
- H01F 27/385 . . . { for reducing harmonics }
  
- H01F 27/40 . Structural association with built-in electric component, e.g. fuse
- H01F 27/402 . . { Association of measuring or protective means }
  
- H01F 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](#) )
- H01F 27/422 . . { for instrument transformers }
- H01F 27/425 . . . { for voltage transformers }
- H01F 27/427 . . . { for current transformers }
  
- H01F 29/00** **Variable transformers or inductances not covered by group [H01F 21/00](#) ( tap change devices [H01H 9/0005](#) ) }**
  
- H01F 29/02 . with tapplings on coil or winding ; with provision for rearrangement or interconnection of windings
- H01F 29/025 . . { Constructional details of transformers or reactors with tapping on coil or windings }
- H01F 29/04 . . having provision for tap-changing without interrupting the load current
- H01F 29/06 . with current collector gliding or rolling on or along winding
- H01F 29/08 . with core, coil, winding, or shield movable to offset variation of voltage or phase shift, e.g. induction regulators
- H01F 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](#) ) }
- H01F 29/12 . . having movable coil, winding, or part thereof ; having movable shield
- H01F 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](#) } )
- H01F 29/146 . . { Constructional details }
  
- H01F 30/00** **Fixed transformers not covered by group [H01F 19/00](#)**
  
- H01F 30/02 . Auto-transformers
  
- H01F 30/04 . having two or more secondary windings, each supplying a separate load, e.g. for radio set power supplies



- H01F 30/06 . characterised by the structure
- H01F 30/08 .. without magnetic core
- H01F 30/10 .. Single-phase transformers ( [H01F 30/16](#) takes precedence )
- H01F 30/12 .. Two-phase, three-phase or polyphase transformers
- H01F 30/14 ... for changing the number of phases
- H01F 30/16 .. Toroidal transformers
  
- H01F 36/00** **Transformers with superconductive windings or with windings operating at cryogenic temperature ( [superconducting magnets](#) or [superconducting coils](#) [H01F 6/00](#) )**
  
- H01F 37/00** **Fixed inductances not covered by group [H01F 17/00](#)**
  
- H01F 37/005 . { without magnetic core }
  
- H01F 38/00** **Adaptations of transformers or inductances for specific applications or functions**
  
- H01F 38/02 . for non-linear operation
- H01F 38/023 .. { of inductances }
- H01F 38/04 .. for frequency changing
- H01F 38/06 .. for changing the wave shape
  
- H01F 38/08 . High-leakage transformers or inductances
- H01F 38/085 .. { Welding transformers }
- H01F 38/10 .. Ballasts, e.g. for discharge lamps
  
- H01F 38/12 . Ignition, e.g. for IC engines
  
- H01F 38/14 . Inductive couplings { ( [for charging batteries from ac mains by converters](#) [H02J 7/025](#) ) }
  
- H01F 38/16 . Cascade transformers, e.g. for use with extra high tension
  
- H01F 38/18 . Rotary transformers
  
- H01F 38/20 . Instruments transformers
- H01F 38/22 .. for single phase ac
- H01F 38/24 ... Voltage transformers
- H01F 38/26 .... Constructions
- H01F 38/28 ... Current transformers
- H01F 38/30 .... Constructions
- H01F 38/32 .... Circuit arrangements
- H01F 38/34 ... Combined voltage and current transformers
- H01F 38/36 .... Constructions
- H01F 38/38 .. for polyphase ac

H01F 38/40 . . . for dc

H01F 38/42 . Flyback transformers

**H01F 41/00 Apparatus or processes specially adapted for manufacturing or assembling the devices covered by this subclass**

H01F 41/005 . { Impregnating or encapsulating ( insulating of windings [H01F 41/12](#) ) }

H01F 41/02 . for manufacturing cores, coils, or magnets ( [H01F 41/14](#) takes precedence; for dynamo-electric machines [H02K 15/00](#) )

H01F 41/0206 . . { Manufacturing of magnetic cores by mechanical means ( magnetic cores per se [H01F 27/24](#) ) }

H01F 41/0213 . . . { Manufacturing of magnetic circuits made from strip(s) or ribbon(s) ( magnetic cores made by winding a ribbon [H01F 27/25](#) ) }

H01F 41/022 . . . . { by winding the strips or ribbons around a coil }

H01F 41/0226 . . . . { from amorphous ribbons }

H01F 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](#) ) }

H01F 41/024 . . . . { Manufacturing of magnetic circuits made from deformed sheets ( magnetic cores made from deformed sheets [H01F 27/2455](#) ) }

H01F 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](#) ) }

H01F 41/0253 . . { for manufacturing permanent magnets }

H01F 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](#) ) }

H01F 41/0266 . . { Moulding; Pressing ( [H01F 41/0273](#) takes precedence; hard magnetic particles [H01F 1/06](#) , [H01F 1/11](#) ) }

H01F 41/0273 . . { Imparting anisotropy ( methods and devices for magnetising permanent magnets [H01F 13/003](#) ) }

H01F 41/028 . . . . { Radial anisotropy ( for rotor or stator bodies [H02K 15/02](#) ) }

H01F 41/0286 . . { Trimming }

H01F 41/0293 . . { diffusion of rare earth elements, e.g. Tb, Dy or Ho, into permanent magnets }

H01F 41/04 . . for manufacturing coils { ( coils for transformer or inductances [H01F 27/28](#) ) }

H01F 41/041 . . { Printed circuit coils ( apparatus or processes for manufacturing printed circuits in general [H05K 3/00](#) ) }

H01F 41/042 . . . . { by thin film techniques }

H01F 41/043 . . . . { by thick film techniques }

H01F 41/045 . . . . { Trimming }

H01F 41/046 . . . . { structurally combined with ferromagnetic material }

H01F 41/047 . . . . { structurally combined with superconductive material }

H01F 41/048 . . { Superconductive coils }

H01F 41/06 . . Winding

H01F 41/0604 . . . . { Winding sheet material }

H01F 41/0608	.....	{ with insulation }
H01F 41/0612	....	{ Winding wire material }
H01F 41/0616	.....	{ with insulation }
H01F 41/062	.....	{ the insulation being strip material }
H01F 41/0625	.....	{ Winding more than one wire }
H01F 41/0629	.....	{ Twisting }
H01F 41/0633	....	{ Devices for guiding or positioning the winding material on the winding form }
H01F 41/0637	.....	{ forming pancake coils }
H01F 41/0641	.....	{ positioning the winding material in a special configuration on the winding form ( orthocyclic coils, open mesh coils ) }
H01F 41/0645	.....	{ using revolving flyers }
H01F 41/065	....	{ Winding coils of special form }
H01F 41/0654	.....	{ Winding on elongate winding forms }
H01F 41/0658	.....	{ Winding flat coils }
H01F 41/0666	....	{ Winding with terminal wrapping or soldering; Winding while forming taps or terminals }
H01F 41/067	....	{ Winding machines having a plurality of work holders or winding forms }
H01F 41/0675	.....	{ Turrets, turntables }
H01F 41/0679	....	{ Tensioning or braking devices }
H01F 41/0683	....	{ Dispensing or feeding devices }
H01F 41/0687	....	{ Winding mandrels, winding forms }
H01F 41/0691	....	{ Winding with deformation of the winding material section }
H01F 41/0695	....	{ Winding while measuring electrical characteristics }
H01F 41/08	....	Winding conductors onto or threading conductors through cores or formers which are closed in themselves, e.g. toroids ( for interconnecting digital storage elements <a href="#">G11C 5/12</a> )
H01F 41/10	...	Connecting leads to windings ( making electric connections in general <a href="#">H01R 43/00</a> )
H01F 41/12	...	Insulating of windings ( { impregnating or encapsulating of transformers <a href="#">H01F 41/005</a> } ; of conductors in general <a href="#">H01B 13/06</a> )
H01F 41/122	....	{ Insulating between turns or between winding layers }
H01F 41/125	....	{ Other insulating structures; Insulating between coil and core, between different winding sections, around the coil }
H01F 41/127	....	{ Encapsulating or impregnating ( encapsulating coil and core <a href="#">H01F 41/005</a> ) }
H01F 41/14	.	for applying magnetic films to substrates ( covering metals, or materials with metals, in general <a href="#">C23C</a> ; manufacturing record carriers <a href="#">G11B 5/84</a> )

**NOTE**

Group [H01F 41/30](#) takes precedence over groups [H01F 41/16](#) to [H01F 41/24](#) , and over group [H01F 41/32](#)

H01F 41/16	..	the magnetic material being applied in the form of particles, e.g. by serigraphy { i.e. forming thick magnetic films and precursors therefor, e.g. magnetisable pastes, inks, glass frits ( <a href="#">H01F 41/18</a> to <a href="#">H01F 41/24</a> take precedence; thick magnetic films
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- [H01F 1/0027](#) ) }
- H01F 41/18 .. by cathode sputtering
- H01F 41/183 ... { Sputtering targets therefor }
- H01F 41/186 ... { for applying a magnetic garnet film ( magnetic garnet materials [H01F 1/346](#) ; magnetic garnet films [H01F 10/24](#) ) }
- H01F 41/20 .. by evaporation
- H01F 41/205 ... { by laser ablation, e.g. pulsed laser deposition (PLD) }
- H01F 41/22 .. Heat treatment ; Thermal decomposition ; Chemical vapour deposition
- H01F 41/24 .. from liquids
- H01F 41/26 ... using electric currents { e.g. electroplating }
- H01F 41/28 ... by liquid phase epitaxy
- H01F 41/30 .. for applying nanostructures, e.g. by molecular beam epitaxy (MBE)
- H01F 41/301 ... { for applying ultrathin or granular layers ( ultrathin or granular layers [H01F 10/007](#) ) }
- H01F 41/302 ... { for applying spin-exchange-coupled multilayers, e.g. nanostructured superlattices ( spin-exchange-coupled multilayers [H01F 10/32](#) ) }
- H01F 41/303 .... { with exchange coupling adjustment of magnetic film pairs, e.g. interface modifications by reduction, oxidation }
- H01F 41/304 ..... { using temporary decoupling, e.g. involving blocking, Néel or Curie temperature transitions by heat treatment in presence/absence of a magnetic field }
- H01F 41/305 .... { applying the spacer or adjusting its interface, e.g. in order to enable particular effect different from exchange coupling }
- H01F 41/306 ..... { conductive spacer }
- H01F 41/307 ..... { insulating or semiconductive spacer }
- H01F 41/308 .... { lift-off processes, e.g. ion milling, for trimming or patterning }
- H01F 41/309 .... { electroless or electrodeposition processes from plating solution }
- H01F 41/32 . for applying conductive, insulating or magnetic material on a magnetic film { , specially adapted for a thin magnetic film }
- H01F 41/325 .. { applying a noble metal capping on a spin-exchange-coupled multilayer e.g. spin filter deposition }

### **WARNING**

This groups is not complete pending the completion of reclassification; see provisionally also [H01F 41/32](#)

- H01F 41/34 .. in patterns, e.g. by lithography

### **Guidance heading:**

- H01F 2003/00 **Cores, Yokes, or armatures** ( magnetic materials [H01F 1/00](#) ; permanent magnets [H01F 7/02](#) )
- H01F 2003/005 . Magnetic cores for receiving several windings with perpendicular axes, e.g. for antennae or inductive power transfer

- H01F 2003/10 . Composite arrangements of magnetic circuits
- H01F 2003/103 . . Magnetic circuits with permanent magnets
- H01F 2003/106 . . Magnetic circuits using combinations of different magnetic materials
  
- H01F 2005/00 **Coils** ( [superconducting coils H01F 6/06](#) ; fixed inductances of the signal type [H01F 17/00](#) )
  
- H01F 2005/006 . with conical spiral form
  
- H01F 2005/02 . wound on non-magnetic supports, e.g. formers
- H01F 2005/022 . . wound on formers with several winding chambers separated by flanges, e.g. for high voltage applications
- H01F 2005/025 . . wound on coaxial arrangement of two or more formers
- H01F 2005/027 . . wound on formers for receiving several coils with perpendicular winding axes, e.g. for antennae or inductive power transfer
  
- H01F 2005/04 . Arrangements of electric connections to coils, e.g. leads
- H01F 2005/043 . . having multiple pin terminals, e.g. arranged in two parallel lines at both sides of the coil
- H01F 2005/046 . . Details of formers and pin terminals related to mounting on printed circuits
  
- H01F 2006/00 **Superconducting magnets ; Superconducting coils** { ( [magnetic resonance assemblies using superconducting coil systems G01R 33/3815](#) ) }
  
- H01F 2006/001 . Constructive details of inductive current limiters
  
- H01F 2007/00 **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](#) )
  
- H01F 2007/06 . 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](#) ; magnetically locked mine lamps [F21L 11/00](#) ; analysing materials by magnetic means [G01N 27/72](#) , [G01N 27/80](#) to [G01N 27/88](#) ; 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](#) ) }
- H01F 2007/062 . . Details of terminals or connectors for electromagnets
- H01F 2007/068 . . using printed circuit coils
- H01F 2007/08 . . with armatures
- H01F 2007/081 . . . { [Magnetic constructions](#) }
- H01F 2007/083 . . . . External yoke surrounding the coil bobbin, e.g. made of bent magnetic sheet

<a href="#">H01F 2007/085</a>	....	Yoke or polar piece between coil bobbin and armature having a gap, e.g. filled with nonmagnetic material
<a href="#">H01F 2007/086</a>	....	Structural details of the armature
<a href="#">H01F 2007/16</a>	...	Rectilinearly-movable armatures ( <a href="#">H01F 7/17</a> takes precedence )
<a href="#">H01F 2007/1607</a>	....	{ <a href="#">Armatures entering the winding</a> }
<a href="#">H01F 2007/163</a>	.....	with axial bearing
<a href="#">H01F 2007/1661</a>	....	Electromagnets or actuators with anti-stick disc
<a href="#">H01F 2007/1669</a>	....	Armatures actuated by current pulse, e.g. bistable actuators
<a href="#">H01F 2007/1676</a>	....	Means for avoiding or reducing eddy currents in the magnetic circuit, e.g. radial slots
<a href="#">H01F 2007/1684</a>	....	Armature position measurement using coils
<a href="#">H01F 2007/1692</a>	....	Electromagnets or actuators with two coils
<a href="#">H01F 2007/18</a>	...	Circuit arrangements for obtaining desired operating characteristics, e.g. for slow operation, for sequential energisation of windings, for high-speed energisation of windings
<a href="#">H01F 2007/1805</a>	....	{ <a href="#">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 <a href="#">H01H 47/04</a> ; quick energising of electro-dynamic machines <a href="#">H02P 9/08</a> ; for quickly de-energising of dynamo-electric generators <a href="#">H02P 9/123</a> )</a> }
<a href="#">H01F 2007/1816</a>	.....	{ <a href="#">making use of an energy accumulator ( for relays <a href="#">H01H 47/043</a> )</a> }
<a href="#">H01F 2007/1822</a>	.....	using a capacitor to produce a boost voltage
<a href="#">H01F 2007/1844</a>	....	{ <a href="#">Monitoring or fail-safe circuits ( for relays <a href="#">H01H 47/002</a> )</a> }
<a href="#">H01F 2007/185</a>	.....	with armature position measurement
<a href="#">H01F 2007/1855</a>	.....	using a stored table to deduce one variable from another
<a href="#">H01F 2007/1861</a>	.....	using derivative of measured variable
<a href="#">H01F 2007/1866</a>	.....	with regulation loop
<a href="#">H01F 2007/1888</a>	....	using pulse width modulation
<a href="#">H01F 2007/1894</a>	....	minimizing impact energy on closure of magnetic circuit
<a href="#">H01F 2007/20</a>	..	without armatures ( <a href="#">cores <a href="#">H01F 3/00</a> ; coils <a href="#">H01F 5/00</a> ; { <a href="#">shaping metal by applying magnetic forces <a href="#">B21D 26/14</a> ; analysing methods using magnetic fields <a href="#">G01N 24/06</a> ; electromagnets specially adapted for NMR applications <a href="#">G01R 33/381</a> }</a> } )</a>
<a href="#">H01F 2007/206</a>	...	{ <a href="#">Electromagnets for lifting, handling or transporting of magnetic pieces or material ( <a href="#">electromagnets for guidance of vehicles, workpieces <a href="#">B61B 31/08</a> , <a href="#">B65G 21/2009</a> ; for magnetic suspension or levitation <a href="#">H02N 15/00</a> )</a> }</a>
<a href="#">H01F 2007/208</a>	....	combined with permanent magnets
<b>H01F 2017/00</b>		<b>Fixed inductances of the signal type ( coils in general <a href="#">H01F 5/00</a> { <a href="#">inductors without a potential-jump or surface barrier specially adapted for integrated circuits, details thereof and multistep manufacturing processes therefor <a href="#">H01L 28/10</a> }</a> } )</b>
<a href="#">H01F 2017/0006</a>	.	{ <a href="#">Printed inductances ( <a href="#">printed coils for dynamo-electric machines <a href="#">H02K 3/26</a> ; printed circuits <a href="#">H05K</a> )</a> }</a>
<a href="#">H01F 2017/0013</a>	..	{ <a href="#">with stacked layers ( <a href="#">H01F 27/2804</a> takes precedence )</a> }
<a href="#">H01F 2017/002</a>	...	Details of via holes for interconnecting the layers

H01F 2017/0026	...	Multilayer LC-filter
H01F 2017/004	..	with the coil helically wound around an axis without a core
H01F 2017/0046	..	with a conductive path having a bridge
H01F 2017/0053	..	with means to reduce eddy currents
H01F 2017/006	..	flexible printed inductors
H01F 2017/0066	..	with a magnetic layer
H01F 2017/0073	..	with a special conductive pattern, e.g. flat spiral
H01F 2017/008	..	Electric or magnetic shielding of printed inductances
H01F 2017/0086	..	on semiconductor substrate ( <a href="#">inductors for integrated circuits H01L 28/10</a> )
H01F 2017/0093	.	Common mode choke coil
H01F 2017/04	.	with magnetic core
H01F 2017/045	..	{ with core of cylindric geometry and coil wound along its longitudinal axis, i.e. rod or drum core }
H01F 2017/046	...	helical coil made of flat wire, e.g. with smaller extension of wire cross section in the direction of the longitudinal axis
H01F 2017/048	..	with encapsulating core, e.g. made of resin and magnetic powder
H01F 2017/06	..	with core substantially closed in itself, e.g. toroid
H01F 2017/065	...	Core mounted around conductor to absorb noise, e.g. EMI filter
H01F 2017/067	...	Core with two or more holes to lead through conductor
H01F 2019/00		<b>Fixed transformers or mutual inductances of the signal type</b> ( <a href="#">H01F 36/00</a> takes precedence )
H01F 2019/04	.	Transformers or mutual inductances suitable for handling frequencies considerably beyond the audio range ( <a href="#">resonant circuits H03H</a> )
H01F 2019/08	..	Transformers having magnetic bias, e.g. for handling pulses
H01F 2019/085	...	Transformer for galvanic isolation
H01F 2021/00		<b>Variable inductances or transformers of the signal type</b> ( <a href="#">H01F 36/00</a> takes precedence )
H01F 2021/12	.	discontinuously variable, e.g. tapped
H01F 2021/125	..	Printed variable inductor with taps, e.g. for VCO
H01F 2027/00		<b>Details of transformers or inductances, in general</b>
H01F 2027/06	.	Mounting, supporting or suspending transformers, reactors or choke coils { not being of the signal type }
H01F 2027/065	..	Mounting on printed circuit boards
H01F 2027/28	.	Coils ; Windings ; Conductive connections
H01F 2027/2804	..	{ Printed windings }
H01F 2027/2809	...	on stacked layers



- H01F 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
- H01F 2027/2819 . . . Planar transformers with printed windings, e.g. surrounded by two cores and to be mounted on printed circuit
- H01F 2027/2823 . . { Wires ( [H01F 27/2866](#) takes precedence ) }
- H01F 2027/2833 . . . using coaxial cable as wire
- H01F 2027/2838 . . . using transposed wires
- H01F 2027/2842 . . . Wire coils wound in conical zigzag to reduce voltage between winding turns
- H01F 2027/2847 . . { Sheets; Strips ( [H01F 27/2866](#) takes precedence ) }
- H01F 2027/2857 . . . Coil formed from wound foil conductor
- H01F 2027/2861 . . . Coil formed by folding a blank
- H01F 2027/29 . . Terminals ; Tapping arrangements { for signal inductances }
- H01F 2027/292 . . . { Surface mounted devices }
- H01F 2027/295 . . . . with flexible terminals
- H01F 2027/297 . . . with pin-like terminal to be inserted in hole of printed path
- H01F 2027/32 . . Insulating of coils, windings, or parts thereof
- H01F 2027/327 . . . { Encapsulating or impregnating ( encapsulating coil and core [H01F 27/022](#) ) }
- H01F 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
- H01F 2027/329 . . . Insulation with semiconducting layer, e.g. to reduce corona effect
- H01F 2027/34 . . Special means for preventing or reducing unwanted electric or magnetic effects, e.g. no-load losses, reactive currents, harmonics, oscillations, leakage fields
- H01F 2027/348 . . Preventing eddy currents
- H01F 2027/40 . . Structural association with built-in electric component, e.g. fuse
- H01F 2027/402 . . { Association of measuring or protective means }
- H01F 2027/404 . . . Protective devices specially adapted for fluid filled transformers
- H01F 2027/406 . . . Temperature sensor or protection
- H01F 2027/408 . . Association with diode or rectifier
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- H01F 2029/00 **Variable transformers or inductances not covered by group [H01F 21/00](#) { ( tap change devices [H01H 9/0005](#) ) }**
- H01F 2029/14 . . 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](#) } )
- H01F 2029/143 . . with control winding for generating magnetic bias
- 
- H01F 2038/00 **Adaptations of transformers or inductances for specific applications or functions**
- H01F 2038/003 . . High frequency transformer for microwave oven
- H01F 2038/006 . . matrix transformer consisting of several interconnected individual transformers working as a whole
- H01F 2038/02 . . for non-linear operation

H01F 2038/023	.. { of inductances }
H01F 2038/026	... non-linear inductive arrangements for converters, e.g. with additional windings
H01F 2038/12	. Ignition, e.g. for IC engines
H01F 2038/122	.. with rod-shaped core
H01F 2038/125	.. with oil insulation
H01F 2038/127	.. with magnetic circuit including permanent magnet
H01F 2038/14	. Inductive couplings { ( for charging batteries from ac mains by converters <a href="#">H02J 7/025</a> ) }
H01F 2038/143	.. for signals
H01F 2038/146	.. in combination with capacitive coupling
H01F 2038/20	. Instruments transformers
H01F 2038/22	.. for single phase ac
H01F 2038/28	... Current transformers
H01F 2038/30	.... Constructions
H01F 2038/305	..... with toroidal magnetic core
H01F 2038/42	. Flyback transformers
H01F 2038/423	.. with adjusting potentiometers
H01F 2038/426	.. with gap in transformer core
H01F 2041/00	<b>Apparatus or processes specially adapted for manufacturing or assembling the devices covered by this subclass</b>
H01F 2041/02	. for manufacturing cores, coils, or magnets ( <a href="#">H01F 41/14</a> takes precedence; for dynamo-electric machines <a href="#">H02K 15/00</a> )
H01F 2041/04	.. for manufacturing coils { ( coils for transformer or inductances <a href="#">H01F 27/28</a> ) }
H01F 2041/06	... Winding
H01F 2041/065	.... { Winding coils of special form }
H01F 2041/0662	..... Winding saddle or deflection coils