

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](#))

Definition statement

This place covers:

Magnets or magnetic bodies characterised by the magnetic materials therefor. Selection of materials for their magnetic properties ([H01F 1/00](#)).

Thin magnetic films ([H01F 10/00](#)).

Permanent magnets ([H01F 7/00](#)).

Electromagnets ([H01F 7/00](#)) including, for example, superconductive magnets ([H01F 6/00](#)); details thereof such as coils ([H01F 5/00](#)), cores, yokes, and armatures ([H01F 3/00](#)).

Fixed and variable transformers including, for example, superconductive or cryogenic transformers; adaptations thereof for specific applications or functions; details thereof ([H01F 19/00](#), [H01F 21/00](#), [H01F 27/00](#), [H01F 29/00](#), [H01F 30/00](#), [H01F 36/00](#), [H01F 38/00](#)).

Fixed and variable inductances; adaptations thereof for specific applications or functions; details thereof ([H01F 17/00](#), [H01F 21/00](#), [H01F 27/00](#), [H01F 29/00](#), [H01F 37/00](#), [H01F 38/00](#)).

Apparatus or processes for magnetizing or demagnetizing ([H01F 13/00](#)).

Apparatus or processes specially adapted for manufacturing or assembling devices covered by this subclass ([H01F 41/00](#)).

Further information:

Groups [H01F 17/00-H01F 38/00](#) (with the exception of groups [H01F 27/42](#) and [H01F 38/32](#)) cover only structural or constructional aspects of transformers, inductive reactors, chokes or the like. These groups do not cover circuit arrangement of such devices, which are covered by the appropriate functional places.

References

Limiting references

This place does not cover:

Magnets used to separate solid materials from other solid materials or fluids	B03C 1/00
Magnetic work holders	B23Q 3/00 , B25B 11/00
Apparatus or processes for degaussing ships	B63G 9/06
Lifting magnets	B66C 1/00
Magnets or electromagnets in electric meters	G01R
Devices for demagnetizing parts of clocks and watches	G04D 9/00
Magnetic record carriers	G11B 5/00
Apparatus or processes specially adapted for manufacturing magnetic record carriers	G11B 5/84

Thin-film magnetic stores	G11C
Apparatus or processes for threading magnetic cores in digital storage elements	G11C 5/12
Magnets or electromagnets in relays	H01H
Magnets or electromagnets in dynamo-electric machines	H02K
Methods or apparatus specially adapted for manufacturing, assembling, maintaining or repairing dynamo-electric machines, e.g. forming windings prior to mounting into the machine	H02K 15/00
Arrangements for controlling transformers, reactors or choke coils for the purpose of obtaining a desired output	H02P 13/00
Magnetic amplifiers	H03F
Impedance networks	H03H
Demagnetizing arrangements for color television	H04N 9/29
Acoustic electromechanical transducers having coils or permanent magnets	H04R

Informative references

Attention is drawn to the following places, which may be of interest for search:

Powder metallurgy	B22F
Iron oxides (not sintered)	C01G 49/02
Ferrite based ceramics	C04B 35/26
Ferrous alloys	C22C
Coating by evaporation or sputtering	C23C 14/00
Refrigeration machines using magnetic effects	F25B 21/00
Magneto-optical devices	G02F 1/09
Sensing record carriers using inductive or magnetic sensors	G06K 7/08
Semiconductor devices with potential-jump barrier or surface barrier controllable by variation of the magnetic field applied to the devices	H01L 29/82
Thermomagnetic devices	H01L 37/00
Magnetostrictive devices	H01L 41/12
Devices using galvano-magnetic or similar magnetic effects	H01L 43/00
Screening of electric apparatus against magnetic fields	H05K 9/00

Special rules of classification

- Documents are classified with a CPC symbol according to the invention information mainly found in the claims with due regard given to the description and the figures. Additional information found in the claims and in the description and figures, which might be relevant for future searches is given an Indexing Code symbol.
- Main groups [H01F 1/00](#), [H01F 10/00](#) and subgroups [H01F 41/14-H01F 41/34](#):

Classification proceeds by assigning the most restricted possible CPC symbol to the document, followed by additional knowledge tagging using Indexing Code symbols. This implies that CPC head subgroups (corresponding to IPC subgroups) should only be used if no other possibility could be found for classifying the document in a more restricted subgroup.

If the set of claims comprises product or article and method claims an CPC symbol should be assigned to each of these categories. However if the most suitable subgroup for a claim of a given category, e.g. product, does not exist in the main group of the same category, e.g. product group, and can only be found in groups of another corresponding category, e.g. a group for a method to manufacture the product, this latter subgroup should be assigned to the claim e.g. method subgroup assigned to a product claim. For example a document with no method claims dealing with a magnetic tunnel junction in which the spacer has been processed in such a way that its material structure becomes inventive, would still be given the method CPC symbol [H01F 41/307](#) as product CPC symbol [H01F 10/3254](#) is silent over any material inventive features.

Another use of Indexing Codes can be made for particular cases where the invention is a specific property of a given type of material or article and this property is classified only in subgroups of another specific material type. In this case the corresponding CPC symbol cannot be given. Consequently the Indexing Code should be given together with an CPC symbol corresponding to the material described in the document. For example: a sintered nanocomposite exchange spring magnet of SmCo/Fe cannot be given [H01F 1/0579](#) as CPC symbol since the latter symbol belongs to NdFeB magnets classification subtree. Therefore the combination [H01F 1/0557](#) and [H01F 1/0579](#) should be used.

- Remaining main groups of [H01F](#):

Multi-aspect classification is used. This means that several subgroups are assigned to a document if several relevant features are present. It is, for example, not mandatory to use the next general subgroup [H01F 27/28](#) for transformer windings if printed winding ([H01F 27/2804](#)) and wire winding ([H01F 27/2823](#)) are combined in one transformer. Instead, subgroups [H01F 27/2804](#) and [H01F 27/2823](#) are both assigned to the respective document.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Compound	homogenous substance comprising at least two elements, having a non-metallic character and a specific (fixed) composition ratio, including also intermetallic compounds.
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H01F 1/00

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

Definition statement

This place covers:

Bulk magnetic materials: antiferromagnetic, diamagnetic, paramagnetic, hard and soft ferromagnetic materials.

0D, 1D and 2D magnetic (nano)structures.

Materials cover metallic materials, compounds (i.e. mainly non-metallic materials) or organic materials. Selected types of magnetic materials are highlighted within specific subgroups.

[H01F 1/00](#) is mainly concerned with bulk materials except for some specific subgroups.

[H01F 1/0009](#) covers antiferromagnetic bulk material.

[H01F 1/0018](#) covers diamagnetic or paramagnetic bulk material.

[H01F 1/0027](#) covers thick magnetic films formed with methods classified under [H01F 41/16](#).

References

Limiting references

This place does not cover:

Methods to manufacture magnetic hard or soft articles out of said materials	H01F 41/00- H01F 41/0293
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Working metallic powder; manufacturing powder (related to H01F 1/0045 ; H01F 1/06 ; H01F 1/20 - H01F 1/28)	B22F 1/00 , B22F 1/02 , B22F 9/00
Iron oxides carriers (related to H01F 1/342 , H01F 1/36)	C01G 49/02
Making alloys by powder metallurgy (related to H01F 1/0045 ; H01F 1/06 ; H01F 1/20 - H01F 1/28 ; H01F 1/14766 ; H01F 1/14708)	C22C 1/04
Non-ferrous alloys containing 5-50% by weight of oxides, carbides, borides, nitrides, silicides etc. (related to H01F 1/09 , H01F 1/33 , H01F 1/14708 , H01F 1/14766)	C22C 32/00
Making ferrous alloys (related to H01F 1/14708 , H01F 1/14766)	C22C 33/00
Cast iron alloys (related to H01F 1/14708 , H01F 1/14766)	C22C 37/00
Ferrous alloys (related to H01F 1/14708 , H01F 1/14766)	C22C 38/00
Amorphous alloys and related processes (related to H01F 1/153)	C22C 45/00
Single crystal growth, unidirectional solidification (related to H01F 1/0072)	C30B
Electromagnetic interference suppressing, shielding (related to H01F 1/26 , H01F 1/28)	H05K 9/0073

Special rules of classification

Treatment of the materials, e.g. compacting, sintering, bonding are also classified into this group.

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](#))}

Definition statement

This place covers:

These subgroups cover:

0D, 1D and 2D magnetic (nano)structures wherein the size and carriers confinement alters the magnetic properties. Embedded magnetic nanostructures.

References

Limiting references

This place does not cover:

Hard magnetic particles	H01F 1/06- H01F 1/09 and H01F 1/11- H01F 1/117
Nanosized particles used in magnetic cores, electromagnetic noise suppressing sheets	H01F 1/20- H01F 1/33 and H01F 1/36- H01F 1/38
Magnetorheological fluids	H01F 1/44- H01F 1/447

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Nuclear magnetic resonance imaging: preparations for testing in vivo including magnetic particles	A61K 49/06
Magnetic separation process including magnetic particles	B03C 1/01

Special rules of classification

1. Nanoparticles used in bioscreening (diagnostic, separation) are classified in these subgroups irrelevant of their composition and size effect.
2. If a strong effect of the size of the nanoparticles belonging to the groups cited in the above table is shown on the magnetic properties, then it is also classified in [H01F 1/0036-H01F 1/0063](#)

H01F 1/01

of inorganic materials ([H01F 1/44](#) takes precedence)

Definition statement

This place covers:

Magnetocaloric materials. Subdivided in metallic or compounds materials.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Cryogenic machines using magnetic effects based on a magnetocaloric material	F25B 21/00
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H01F 1/03

characterised by their coercivity {(H01F 1/40 takes precedence)}

Definition statement

This place covers:

Materials with specific coercivity; Laves phases or magnetic shape memory materials. Mainly those latter examples are classified in these subgroups.

H01F 1/032

of hard-magnetic materials

Definition statement

This place covers:

Hard magnetic metals or alloys characterised by composition, by shape and by the process or treatments to obtain articles including these materials.

Subgroup [H01F 1/0579](#) is concerned with nanocomposite exchange spring magnets.

[H01F 1/057](#) covers so-called R-T-B magnets (Nd₂Fe₁₄B phase).

[H01F 1/059](#) covers magnets with a Sm₂Fe₁₇N₂ phase.

References

Limiting references

This place does not cover:

Permanent magnets with emphasis on the structure or use rather than the material	H01F 7/02
Method claims directed at manufacturing or treating magnets	H01F 41/0253 - H01F 41/0293
Actuators, dynamo-electric rotating machines, motors (related to H01F 1/053 - H01F 1/059)	H02K 1/00

Special rules of classification

Magnets obtained from the corresponding materials are classified in the same subgroups according to method criteria (process or treatments undergone by the material forming the magnet) on which part of the classification refinement is based.

H01F 1/06

in the form of particles, e.g. powder ([H01F 1/047](#) takes precedence {; record carriers [G11B 5/70605](#)})

Definition statement

This place covers:

Hard magnetic metallic particles characterised by shape and by treatments to obtain articles including these materials.

The subgroups are generally concerned with particles used in magnetic recording or under subgroup [H01F 1/08](#) metallic particles for permanent magnets when composition is not specifically mentioned in the claims.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Magnetic record carriers	G11B 5/00
Magnetic record carriers (metal or alloy material, related to H01F 1/06+)	G11B 5/70605
Magnetic record carriers (non-metallic material, related to H01F 1/11)	G11B 5/70626
Apparatus or processes specially adapted for manufacturing magnetic record carriers	G11B 5/84

H01F 1/09

mixtures of metallic and non-metallic particles; metallic particles having oxide skin

Definition statement

This place covers:

Hard magnetic non-metallic particles characterised by shape and by treatments to obtain articles including these materials.

[H01F 1/09](#) can cover hard metallic particles covered with an oxide layer

Special rules of classification

For rare earth containing particles covered with an oxide layer, subgroups [H01F 1/0552](#) and [H01F 1/0572](#) would take precedence except if the oxide layer is the core of the invention.

H01F 1/10

non-metallic substances, e.g. ferrites {, e.g. [(Ba,Sr)O(Fe₂O₃)₆] ferrites with hexagonal structure}

Definition statement

This place covers:

Hard non-metallic magnets such as Ba-ferrite type of magnets

H01F 1/12

of soft-magnetic materials

Definition statement

This place covers:

Soft magnetic metals or alloys characterised by composition, by shape and treatments to obtain articles including these materials.

Special rules of classification

Fe-Ni and Fe-Si alloys and their shape are classified in the subgroups [H01F 1/14708-H01F 1/14791](#).

Other compositions than Fe-Ni, Fe-Si must be classified according to a shape criterion: subgroups [H01F 1/16](#) and onwards for sheets, [H01F 1/20](#) and onwards for particles and [H01F 1/143](#) for wires or for no specific shape given: subgroup [H01F 1/147](#). If no specific shape or composition criterion is given, the [H01F 1/14](#) symbol should be given.

H01F 1/153

Amorphous metallic alloys, e.g. glassy metals {(making ferrous amorphous alloys [C22C 33/003](#))}

Definition statement

This place covers:

Soft magnetic amorphous metals, also including nanocrystallites, characterised by composition and by methods to obtain articles including these materials.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Security coding	G07D 7/00
Alarms using amorphous ferromagnetic tags	G08B 13/2408

Special rules of classification

The method section of these subgroups has to be used in combination with the method subgroups [H01F 41/0206-H01F 41/0246](#).

H01F 1/16

in the form of sheets ([H01F 1/147](#) takes precedence)

Definition statement

This place covers:

Soft magnetic sheet of metals or alloys.

[H01F 1/18](#) covers insulated sheets

H01F 1/20

in the form of particles, e.g. powder ([H01F 1/147](#) takes precedence)

Definition statement

This place covers:

Soft magnetic particles of metals or alloys characterised by shape and by treatments or methods to obtain articles including these materials.

[H01F 1/20](#) covers particles

[H01F 1/22](#) covers compacted particles.

[H01F 1/24](#) covers insulated compacted particles.

[H01F 1/26](#) covers compacted particles wherein insulator are organic macromolecules.

Subgroup [H01F 1/28](#) concerns non compacted bodies.

Special rules of classification

Soft magnetic particles compacted in a bonded body (magnetic core or noise suppressing sheet) are classified in [H01F 1/26](#) in combination with [H01F 41/0246](#) for magnetic cores only.

H01F 1/33

mixtures of metallic and non-metallic particles; metallic particles having oxide skin

Definition statement

This place covers:

Soft metallic particles covered with an oxide layer.

H01F 1/34

non-metallic substances, e.g. ferrites

Definition statement

This place covers:

Soft non-metallic materials characterised by composition, by shape and treatments to obtain articles including these materials.

[H01F 1/34](#) covers bulk non metallic material such as ferrite.

[H01F 1/36](#) covers non-metallic particles.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Ferrite based ceramics described only by chemical composition	C04B 35/26
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Special rules of classification

Subgroup [H01F 1/24](#) would take precedence in the case of oxide insulated particles being part of a compacted body.

H01F 1/40

of magnetic semiconductor materials, e.g. CdCr₂S₄ (devices using galvanomagnetic or similar effects [H01L 43/00](#))

Definition statement

This place covers:

Magnetic semiconductors and half-metals (Heusler).

Special rules of classification

Perovskites ([H01F 1/407](#)) and half-metals ([H01F 1/408](#)) are classified under the arborescence of magnetic semiconductors even if they might not be necessarily a semiconducting material.

H01F 1/42

of organic or organo-metallic materials {, e.g. graphene} ([H01F 1/44](#) takes precedence)

Definition statement

This place covers:

Organic or organo-metallic materials.

H01F 1/44

of magnetic liquids, e.g. ferrofluids (particles in a bonding agent [H01F 1/28](#), [H01F 1/36](#), {[H01F 1/37](#)})

Definition statement

This place covers:

Magnetic and magnetorheologic fluids.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Nuclear magnetic resonance imaging: preparations for testing in vivo including magnetic particles	A61K 49/06
Magnetorheological fluid dampers including a ferrofluid	F16F 9/535

H01F 3/00

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

Definition statement

This place covers:

Cores, yokes and armatures which are single parts or arrangements of several parts of ferromagnetic material used to guide magnetic flux.

Further information:

- Cores, yokes and armatures are covered by [H01F 3/00](#) if:- no specific application is mentioned,- a special application is mentioned for which no specific subgroup exists elsewhere,- they comprise specific features for which no subgroups exist in the specific subgroup for the application (e.g. transformer cores which are normally classified in [H01F 27/24](#) have to be classified in [H01F 3/10](#) if they are made from a combination of materials and in [H01F 3/14](#) if they comprise air gaps).
- [H01F 3/02](#) and [H01F 3/04](#):A core made from a stack of strips is covered by [H01F 3/02](#) although this subgroup refers to sheets.The subgroup [H01F 3/04](#) for strips and ribbons predominantly covers cores which are fabricated by winding the strips on a mandrel.

References

Limiting references

This place does not cover:

Magnetic materials per se	H01F 1/00
Permanent magnets	H01F 7/02

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Magnet cores of signal inductances	H01F 17/04
Details of magnet cores of transformers or inductances in general	H01F 27/24
Magnetic shunt path in the case of transformers/inductances (related to H01F 3/12)	H01F 27/38
Apparatus or processes for manufacturing magnet cores	H01F 41/0206
Magnetic cores for electric motors/generators	H02K 1/00

H01F 5/00

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

Definition statement

This place covers:

Printed coils.

Wound electric conductors.

Further information:

- Coils are covered by [H01F 5/00](#), if:- no specific application is mentioned,- a special application is mentioned for which no specific subgroups exist elsewhere,- they comprise specific features for which no subgroups exist in the specific subgroup for the application (e.g. a bobbin for an electromagnet is classified in [H01F 5/02](#) although electromagnets are normally classified in [H01F 7/06](#)).
- [H01F 5/04](#):This subgroup predominantly refers to terminals attached to bobbins.Bobbins characterised by details for attaching terminals are classified here and not in the subgroup [H01F 5/02](#) for bobbins.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Superconducting coils	H01F 6/06
Printed coils for signal inductances	H01F 17/0006
Coils for transformers/inductances	H01F 27/28
Printed coils for transformers/inductances	H01F 27/2804

Bobbins for transformers/inductances (related to H01F 5/02)	H01F 27/325
Bobbins in relation with apparatus or processes for manufacturing coils (related to H01F 5/02)	H01F 41/098
Loop aerials (antennae)	H01Q 7/00
Coils for electric motors/generators	H02K 3/00
Coil arrangements for induction heating	H05B 6/36

Informative references

Attention is drawn to the following places, which may be of interest for search:

Apparatus or processes for manufacturing coils	H01F 41/04
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Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "former" and "bobbin, spool, (coil/winding) support, (coil/winding) body, tube, sleeve"
- "coil" and "winding, solenoid"

H01F 6/00

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

Definition statement

This place covers:

Superconducting magnets and coils and accessories necessary to operate them.

Further information:

- Superconducting magnets can be superconducting bulk pieces cooled below the critical temperature in a magnetic field or superconducting coils. For use as magnets, the coils are often shorted ("persistent mode" or "persistent current mode").
- Constructive details of inductive superconducting current limiters are covered by [H01F 6/00](#).

References

Limiting references

This place does not cover:

Superconductive cables	H01B 12/00
Devices using superconductivity in general	H01L 39/00
Resistive superconducting current limiters (related to H01F 6/00)	H01L 39/16

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Superconducting transformers	H01F 36/00
Superconducting coils used in magnetic separation of materials (related to H01F 6/06)	B03C 1/0337 , B03C 1/0355

Magnet systems for NMR using superconducting coils (related to H01F 6/06)	G01R 33/3815
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Apparatus or processes for manufacturing superconductive coils	H01F 41/048
Emergency protective circuits for limiting excessive current using superconducting elements (related to H01F 6/00)	H02H 9/023

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](#))

Definition statement

This place covers:

Magnets in general.

Further information:

- The two principal subgroups are [H01F 7/02](#) for permanent magnets and [H01F 7/06](#) for electromagnets.
- Electromagnets comprising permanent magnets in any part of the magnetic circuit are covered as follows:- by [H01F 7/1615](#) or [H01F 7/1646](#) if they comprise a rectilinearly movable armature,- by [H01F 7/122](#) if the armature is not or not only rectilinearly movable,- by [H01F 7/20](#) if they do not comprise a movable armature.

References

Limiting references

This place does not cover:

Superconducting magnets	H01F 6/00
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Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

[H01F 7/00](#) in general:

Magnets or electromagnets for electric meters	G01R
Magnets or electromagnets for relays	H01H
Magnets or electromagnets for dynamo-electric machines	H02K

Permanent magnets (H01F 7/02):

Magnets for fastening garments	A41F 1/002
Magnetic fasteners for bags	A45C 13/1069
Magnets used to separate solid materials from other solid materials or fluids	B03C 1/00
Chucks using magnetic means	B23B 31/28
Devices for holding work using magnetic or electric force acting directly on the work	B23Q 3/15
Magnetic work holders	B25B 11/002
Screwdrivers using magnetic means	B25B 23/12
Gripping heads with magnetic holding means	B25J 15/0608
Load-engaging elements for cranes attached by magnetic means	B66C 1/04
Treatment of water by magnetic fields using permanent magnets	C02F 1/481

Electromagnets (H01F 7/06):

Load engaging elements: electromagnetic means (related to H01F 7/20)	B66C 1/06
Magnet systems for NMR using electromagnets (related to H01F 7/20)	G01R 33/381

Informative references

Attention is drawn to the following places, which may be of interest for search:

Permanent magnets (H01F 7/02):

Demagnetization of permanent magnets by coils	H01F 13/006
Fastening by use of magnets (jewellery, haberdashery)	A44D 2203/00
Devices for hanging or supporting pictures, mirrors, or the like using magnetism	A47G 1/17
Magnetic cleaning implements	A47L 13/41
Magnetic dental implant retention systems	A61C 8/0081
Magnetic fastening of teeth prostheses in mouth	A61C 13/235
Toys: building blocks comprising magnetic interaction means	A63H 33/046
Magnetic mixers/stirrers	B01F 13/08
Securing wings by magnetic or electromagnetic attraction	E05C 19/16
Devices for securing together, or preventing relative movement between, constructional elements or machine parts by the use of a magnetic material	F16B 2001/0035
Electromagnetic valve actuated using a permanent magnet	F16K 31/08
Fastening of component parts of lighting devices using magnets	F21V 17/105
Supporting, suspending, or attaching arrangements for lighting: magnetic devices	F21V 21/096
Faraday rotators (magnetic field generation)	G02F 1/09
Educational appliances having elements to be mounted on a support by means of magnets	G09B 1/08

Educational appliances comprising elements to be used without a special support, the elements being connectible magnetically	G09B 1/38
Planning boards using magnetic elements	G09B 29/002

Electromagnets ([H01F 7/06](#)):

MEMS with flexible or deformable elements (related to H01F 7/08)	B81B 3/00
Valve-gear or valve arrangements actuated by electric means	F01L 9/04
Electrical control of supply of combustible mixture or its constituents: output circuits, e.g. for controlling currents in command coils (related to H01F 7/18)	F02D 41/20
Fuel injectors using electromagnetic operating means	F02M 51/061
Fuel injectors with movable windings (related to H01F 7/066)	F02M 51/0696
Control or regulating systems: automatic controllers (related to H01F 7/18)	G05B 11/00
Magnetic circuit arrangements for electromagnetic relays (related to H01F 7/081)	H01H 50/16
Electromagnetic relays in general	H01H 51/00
Actuators based on magnetostriction	H01L 41/12
Motors with reciprocating/oscillating/vibrating magnet/armature/coil	H02K 33/00
Propulsion systems (e.g. linear motors)	H02K 41/00
Acoustic electromechanical transducers having coils or permanent magnets	H04R

Special rules of classification

Although magnets are normally classified in the respective subgroups of an application when provided for, the presence of features for which an appropriate subgroup does not exist in the application main group but in [H01F 7/00](#), requires the respective subgroup in [H01F 7/00](#) to be allocated.

For example, an electromagnetically actuated valve which is normally classified in [F16K 31/06](#), should also be classified in [H01F 7/10](#) for details concerning the use of alternating current for powering the actuator.

H01F 10/00

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

Definition statement

This place covers:

Hard and soft ferromagnetic thin films. Antiferromagnetic thin films. Single layers and (spin-exchanged coupled) multilayers are both considered as thin films.

Thin film materials cover metallic materials, compounds or organic materials.

[H01F 10/00](#) is concerned with ferromagnetic or antiferromagnetic materials in the form of thin films.

A thin film is generally less than a couple of microns thick and can be defined as being manufactured by the methods classified in subgroups [H01F 41/18](#)-[H01F 41/34](#).

[H01F 10/002](#) covers antiferromagnetic, single layer, thin films.

[H01F 10/005](#) covers organic or organo-metallic thin films. Graphene thin films are also given this symbol in case magnetic properties are claimed.

[H01F 10/007](#) covers granular thin films.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Measuring magnetic variables: magnetoresistive sensors (related to H01F 10/324)	G01R 33/093
Magnetic recording heads (related to H01F 10/324)	G11B 5/127

Informative references

Attention is drawn to the following places, which may be of interest for search:

Alloys based on Ni; alloys based on Co (related to H01F 10/14 ; H01F 10/16)	C22C 19/00
Ferrous alloys (related to H01F 10/14)	C22C 38/00
Amorphous alloys and related processes (related to H01F 10/13)	C22C 45/00
Single crystal growth of garnets (related to H01F 10/24)	C30B 29/28
Magneto-optic materials (related to H01F 10/24)	G02F 1/0036
Semiconductor devices with potential-jump barrier or surface barrier controllable by variation of the magnetic field applied to the devices, e.g. spin (valve) transistor, spin injection device (related to H01F 10/324 , H01F 10/1936)	H01L 29/82
Devices using magnetic effects; Selection of materials for (related to H01F 10/324)	H01L 43/00 , H01L 43/10

H01F 10/06

characterised by the coupling or physical contact with connecting or interacting conductors

Definition statement

This place covers:

Thin films characterised by contact with conductors.

H01F 10/08

characterised by magnetic layers ({[H01F 10/32](#) takes precedence } ; applying thin magnetic films to substrates [H01F 41/14](#))

Definition statement

This place covers:

Single layer thin films characterised by properties or composition.

H01F 10/10

characterised by the composition

Definition statement

This place covers:

Metallic single layer thin films characterised by their composition, e.g. amorphous, crystalline.

H01F 10/18

being compounds

Definition statement

This place covers:

Compounds single layer thin films characterised by their composition. Further divided in amorphous, magnetic semiconductors, half-metals (Heusler), perovskites and ferrites.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Photonic crystals	G02B 6/1225
Magneto-optic devices (Faraday-rotator)	G02F 1/09

H01F 10/26

characterised by the substrate or intermediate layers {([H01F 10/06](#) and [H01F 10/32](#) take precedence)}

Definition statement

This place covers:

Multilayers characterised by intermediate layers.

[H01F 10/30](#) covers specific seed, template and cap layers.

H01F 10/32

Spin-exchange-coupled multilayers, e.g. nanostructured superlattices {(applying spin-exchange-coupled multilayers to substrates [H01F 41/302](#))}

Definition statement

This place covers:

Spin-exchange-coupled multilayers characterised by the interaction between the different layers and refined by composition of the single interacting layers.

Special rules of classification

Multilayers with perpendicular magnetic anisotropy of the type of (Co/Pt)_n are also classified in [H01F 10/3236](#) but [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}

Definition statement

This place covers:

Spin-exchanged-coupled multilayers characterised by having a thin non-magnetic spacer between magnetic layers.

Typical TMR and GMR structures.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Magnetic record carriers	G11B 5/00
Magnetic storage elements, non volatile memories, MRAM	G11C 11/15 , G11C 11/16

Informative references

Attention is drawn to the following places, which may be of interest for search:

Magnetostrictive devices;	H01L 41/12
Selection of materials therefor	H01L 41/20

Special rules of classification

Tunnel magnetic junctions (a tunnel barrier sandwiched between two magnetic layers) are classified in [H01F 10/3254](#).

However TMR junctions with additional pinning of one of the magnetic layers (by an AF layer or a SAF/AAF multilayer) do not have a subgroup of [H01F 10/3254](#) where they can be classified. Therefore an Indexing Code of [H01F 10/3268-H01F 10/3281](#) is generally additionally given.

Spin valves (GMR structures) with no specificity of the magnetic layers are generally classified under [H01F 10/325](#).

If no subgroup in [H01F 10/00](#) can reflect the invention of a product claim for a spin-exchanged-coupled multilayer, subgroup from the corresponding method subgroups [H01F 41/302-H01F 41/309](#) is assigned when appropriate.

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](#))

Definition statement

This place covers:

Apparatus or processes for magnetising permanent magnets or for demagnetising magnetic bodies.

References

Limiting references

This place does not cover:

Apparatus or processes for degaussing ships	B63G 9/06
Demagnetising devices for clocks or watches	G04D 9/00
Recording or erasing of information on magnetic record carriers	G11B 5/00
Demagnetizing arrangements for colour televisions	H04N 9/29

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Imparting anisotropy to permanent magnet material (e.g. aligning magnetic grains in a magnetic field)	H01F 41/0273
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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](#)})

Definition statement

This place covers:

Inductances of fixed value not used /useable for high power.

Further information:

"Signal type" means that these inductances are not used/useable for high power.

References

Limiting references

This place does not cover:

Coils in general	H01F 5/00
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Fixed inductances used/useable for high power	H01F 37/00
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Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptations of transformers for special applications or functions	H01F 38/00
Inductive arrangements for semiconductor devices not otherwise provided for (related to H01F 17/0006)	H01L 23/645
Inductors for integrated circuits and corresponding multistep methods of manufacture (related to H01F 17/0006)	H01L 28/10
Loop aerials with ferromagnetic core (related to H01F 17/04)	H01Q 7/06
Impedance networks	H03H
Printed circuits incorporating printed inductors (related to H01F 17/0006)	H05K 1/165

Informative references

Attention is drawn to the following places, which may be of interest for search:

Inductive arrangements or effects between of or between wiring layers of semiconductor devices (related to H01F 17/0006)	H01L 23/5227
Integrated circuits comprising only passive thin-film elements (related to H01F 17/0006)	H01L 27/01
Thin- or thick-film solid state devices (related to H01F 17/0006)	H01L 49/02

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "inductance" and "inductor, choke, reactor, reactance"

H01F 19/00

Fixed transformers or mutual inductances of the signal type ([H01F 36/00](#) takes precedence)

Definition statement

This place covers:

Transformers or coupled inductances.

Further information:

"Signal type" means that these transformers or inductances are not used/useable for high power.

The subgroups basically define different frequency ranges.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Transformers with superconductive windings	H01F 36/00
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Adaptations of transformers or inductances for special applications or functions	H01F 38/00
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H01F 21/00

Variable inductances or transformers of the signal type ([H01F 36/00](#) takes precedence)

Definition statement

This place covers:

Transformers or inductances which are variable and not used/useable for high power.

Further information:

- "Signal type" means that these transformers or inductances are not used/useable for high power.

References

Limiting references

This place does not cover:

Variable inductances/transformers not being of the signal type (i.e. variable inductances/transformers used/usable for high power)	H01F 29/00
Transformers with superconductive windings	H01F 36/00
Magnetic amplifiers	H03F

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptations of transformers or inductances for special applications or functions	H01F 38/00
Means for converting output of a sensing member to another variable: varying inductance	G01D 5/20

Informative references

Attention is drawn to the following places, which may be of interest for search:

Variable inductances including MEMS (related to H01F 21/04 or H01F 21/06)	B81B 3/00
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H01F 27/00

Details of transformers or inductances, in general

Definition statement

This place covers:

Constructional features of transformers or inductances in general.

Further information:

In this group no distinction is made between "signal type" and "power type" applications except for the cases mentioned below. "Power type" means that these transformers or inductances are used/useable for high power.

[H01F 27/00](#) covers constructional features of transformers and inductances falling under the titles of [H01F 17/00](#) - [H01F 21/00](#) and [H01F 29/00](#) - [H01F 38/00](#). If a subgroup for a specific detail exists under [H01F 17/00](#) - [H01F 21/00](#) and [H01F 29/00](#) - [H01F 38/00](#), this subgroup takes precedence over [H01F 27/00](#).

[H01F 27/00](#) also covers details of cores, coils and magnetising arrangements in [H01F 3/00](#) - [H01F 7/00](#) and [H01F 13/00](#) if there is no appropriate subgroup for the respective constructional features in the [H01F 3/00](#) - [H01F 7/00](#) and [H01F 13/00](#).

- Example: cooling of coils: For superconducting coils ([H01F 6/00](#)), there is a subgroup for cooling covered by [H01F 6/04](#). For normal-conducting coils, however, which are classified generally in [H01F 5/00](#) and in [H01F 7/20](#) when used as electromagnet, no subgroups for cooling exist. Therefore, applications related to the cooling of normal-conducting coils or electromagnets, in addition to [H01F 5/00](#) or [H01F 7/20](#), have to be classified in an appropriate subgroup of [H01F 27/08](#).
- Although in general, no difference is made between "signal type" and "power type" applications in [H01F 27/00](#), this is not true for the mounting of transformers/inductances; [H01F 27/027](#) covers the mounting of "signal type" applications; [H01F 27/06](#) covers the mounting of "power type" applications.
- Details related to cooling: Cooling arrangements only for coils are covered by [H01F 27/2876](#); Cooling channels in the insulation of coils are covered by [H01F 27/322](#); Cooling of transformers/inductances, in general, is covered by [H01F 27/08](#) and subgroups; [H01F 27/14](#) covers a wide variety of accessories used for oil-cooled transformers/inductances like oil expansion chambers, gas cushions, oil filters.
- Details related to encapsulation: Devices encapsulated as a whole are covered by [H01F 27/022](#); Encapsulation only of a winding is covered by [H01F 27/327](#).
- Details related to electric/magnetic shields: Shields in general are covered by [H01F 27/36](#); Shields of the winding arrangement are covered by [H01F 27/288](#); Shields of pancake coils are covered by [H01F 27/2871](#).

References

Limiting references

This place does not cover:

Cooling of superconducting coils (related to H01F 27/08)	H01F 6/04
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Buchholz relays (for protecting oil-cooled transformers, related to H01F 27/14 and H01F 27/402)	H01H 33/555
Buchholz relays (for protecting oil-cooled transformers, related to H01F 27/14 and H01F 27/402)	H02H 5/08
Emergency protective circuits for transformers (related to H01F 27/402)	H02H 7/04
Arrangements for controlling transformers, reactors or choke coils for the purpose of obtaining a desired output (field not active anymore)	H02P 13/00
Cooling of electrical devices in general (related to H01F 27/08)	H05K 7/20

H01F 29/00

Variable transformers or inductances not covered by group [H01F 21/00](#) {(tap change devices [H01H 9/0005](#))}

Definition statement

This place covers:

Variable transformers or inductances of the "power type", i.e. used/useable for high power.

References

Limiting references

This place does not cover:

Variable transformers or inductances of the signal type	H01F 21/00
Details of tap change devices regarding the construction, opening mechanism and contact arrangement of the selector switches (related to H01F 29/02)	H01H 9/0005

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptations of transformers or inductances for special applications or functions	H01F 38/00
Use of variable transformers or inductances in automatic systems for regulating voltage or current	G05F 1/10
Amplitude modulation by means of variable impedance element (related to H01F 29/14)	H03C 1/08
Magnetic amplifiers (related to H01F 29/14)	H03F

H01F 30/00

Fixed transformers not covered by group [H01F 19/00](#)

Definition statement

This place covers:

Fixed transformers of the "power type", i.e. used/useable for high power.

Further information:

- The subgroups define different general transformer structures.

References

Limiting references

This place does not cover:

Fixed transformers of signal type	H01F 19/00
Transformers with superconductive windings	H01F 36/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptations of transformers for special applications or functions	H01F 38/00
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H01F 36/00

Transformers with superconductive windings or with windings operating at cryogenic temperature (superconducting magnets or superconducting coils [H01F 6/00](#))

Definition statement

This place covers:

Transformers with superconducting windings.

Transformers with windings operating at cryogenic temperature.

References**Limiting references**

This place does not cover:

Superconducting magnets or coils	H01F 6/00
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Cooling of transformers in general	H01F 27/08
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H01F 37/00

Fixed inductances not covered by group [H01F 17/00](#)

Definition statement

This place covers:

Fixed inductances of "power type", i.e. used/useable for high power.

References**Limiting references**

This place does not cover:

Fixed inductances of signal type	H01F 17/00
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Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Adaptations of inductances for special applications or functions	H01F 38/00
Impedance networks	H03H

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "inductance" and "inductor, choke, reactor, reactance"

H01F 38/00

Adaptations of transformers or inductances for specific applications or functions

Definition statement

This place covers:

Transformers or inductances for specific applications or functions.

Welding transformers and discharge lamp ballasts are covered by [H01F 38/08](#)

even if they do not explicitly have a high leakage (i.e. gap in magnetic flux path).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Rotary transformer for transmission of signals and/or power between stationary and moving part of an X-ray computed tomography (CT) apparatus (related to H01F 38/18)	A61B 6/56
Current collectors for power supply lines of electronically propelled vehicles without mechanical contact between collector and power supply line (related to H01F 38/14)	B60L 5/005
Charging electric vehicles by inductive power transfer (related to H01F 38/14)	B60L 53/12
Circuit arrangements for transfer of electric power between AC networks and DC networks with inductive power transfer (related to H01F 38/14)	H02J 5/005
Non-contact couplings for charging batteries from AC mains by converters (related to H01F 38/14)	H02J 7/025
Near field transmission systems using inductive coupling (related to H01F 38/14)	H04B 5/0075
Ignition circuits for discharge lamps (related to H01F 38/10 and H01F 38/12)	H05B 41/00

H01F 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

Definition statement

This place covers:

Apparatus or processes for manufacturing or assembling transformers, inductances, reactors or choke coils.

Apparatus or processes for manufacturing or assembling magnetic circuits, permanent magnets or coils.

Apparatus or processes for applying magnetic films to substrates and forming magnetic nanostructures.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Manufacturing articles from powder; (related to H01F 41/0246)	B22F 3/00 , B22F 7/00
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H01F 41/005

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

Definition statement

This place covers:

Methods for encapsulating/impregnating. Refers to cases where a whole device (e.g. coil and core of a transformer or a choke) is encapsulated.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Injection moulding incorporating preformed parts	B29C 45/14
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Special rules of classification

Encapsulation only of a winding is to be classified in [H01F 41/127](#).

H01F 41/02

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

Definition statement

This place covers:

Manufacturing of hard or soft magnetic articles. Manufacturing of coils.

H01F 41/0206

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

Definition statement

This place covers:

Methods and apparatus for manufacturing soft magnetic articles characterised by the shape of the magnetic material composing those articles. [H01F 41/14](#) takes precedence.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Manufacturing of coils, cores or magnets for dynamo-electric machines	H02K 15/00
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H01F 41/0253

{for manufacturing permanent magnets}

Definition statement

This place covers:

Methods and apparatus for manufacturing permanent magnets characterised by process steps performed on the magnetic material or on the magnets.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Manufacturing of coils, cores or magnets for dynamo-electric machines	H02K 15/00
---	----------------------------

H01F 41/04

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

Definition statement

This place covers:

Methods and apparatus for manufacturing coils.

Further information:

The most important subgroups are related to:

- printed circuit coils ([H01F 41/041](#)),
- superconducting coils ([H01F 41/048](#)),
- winding ([H01F 41/06](#))
- insulating of windings ([H01F 41/12](#)).

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Manufacturing of coils cores or magnets for dynamo-electric machines	H02K 15/00
--	----------------------------

H01F 41/06

Coil winding

Definition statement

This place covers:

Processes or apparatus for manufacturing coils by winding.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Winding or coil filamentary material	B65H 54/00
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Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Former	Frame, e.g. composed of electrically insulating material, around which a coil is wound. Examples of former are bobbins, spools or winding supports
--------	--

H01F 41/063

with insulation

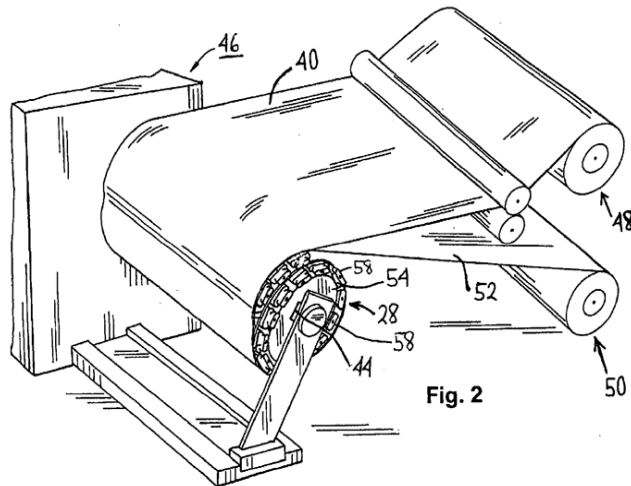
Definition statement

This place covers:

Processes or apparatus for winding flat conductive wires or sheets with insulation.

To be classified here, the conductive wires or sheets and the insulation must initially be separate, and must be wound simultaneously.

The figure below is an example of material classified in this subgroup. In the figure, the conductive sheet 40 and the insulating sheet 52 are wound simultaneously to form an insulated coil.



References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Insulation of windings	H01F 5/06
Insulating of coils, windings, or parts thereof	H01F 27/32
Winding non-flat conductive wires with insulation	H01F 41/066
Insulation of windings	H01F 41/12

H01F 41/066

with insulation

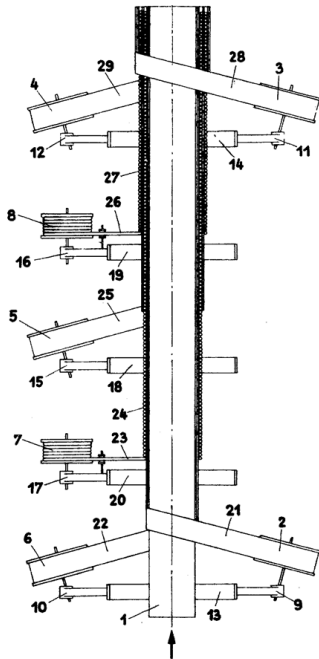
Definition statement

This place covers:

Processes or apparatus for winding non-flat conductive wires with insulation.

To be classified here, the conductive wires or sheets and the insulation must initially be separate and must be wound simultaneously.

The figure below is an example of material classified in this subgroup. In the figure, for example, the conductive wire 24 and the insulation tapes 21 and 22 are wound simultaneously to form an insulated coil.



References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Insulation of windings	H01F 5/06
Insulating of coils, windings, or parts thereof	H01F 27/32
Winding flat conductive wires or sheets with insulation	H01F 41/063
Insulation of windings	H01F 41/12

H01F 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

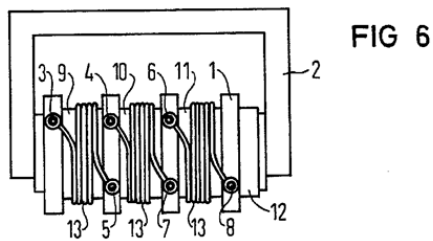
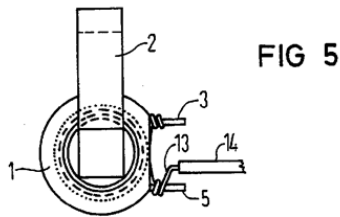
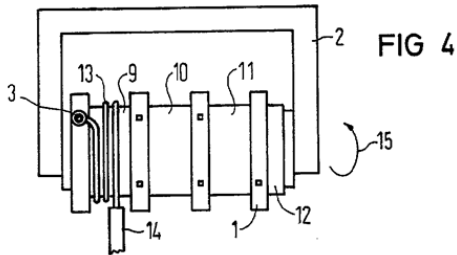
Definition statement

This place covers:

Processes or apparatus for forming taps or terminals while, or in conjunction with winding.

The figure below is an example of material classified in this subgroup. In the figure, the first terminal 3 is wrapped, then the first section 9 of the bobbin 1 is wound. The wire is then wrapped around the

second terminal 5. The terminal connections are thus formed in conjunction with the winding of the bobbin.



H01F 41/077

Deforming the cross section or shape of the winding material while winding

Definition statement

This place covers:

Processes or apparatus for deforming the cross section or shape of the winding material in conjunction with winding.

The figure below is an example of material classified in this subgroup. In the figure, the circular material wire 50 is transformed into the deformed rectangular wire 52 just before winding.

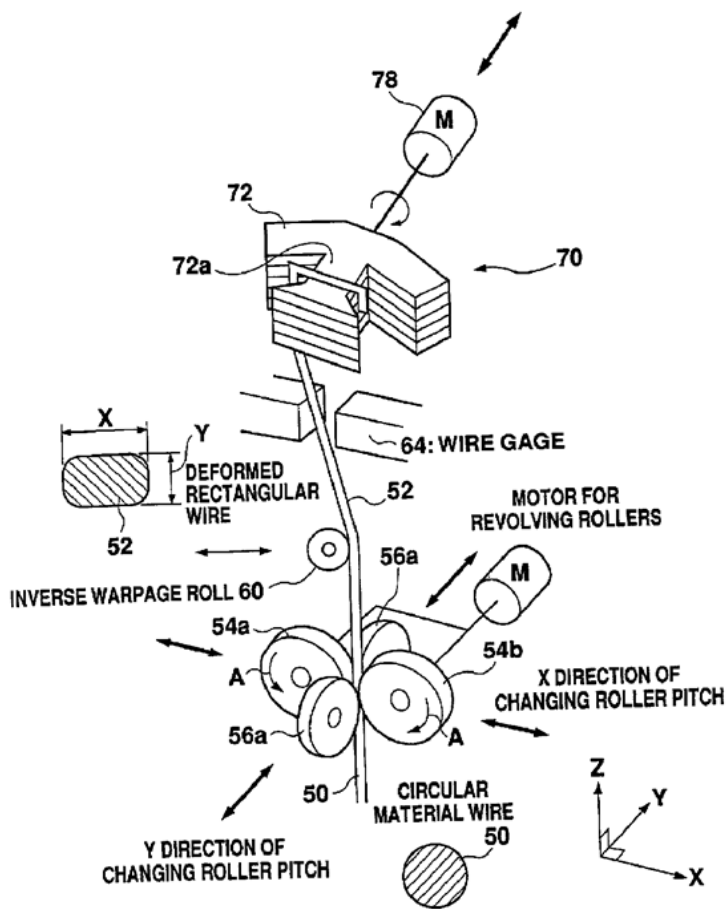


Fig. 13

H01F 41/079

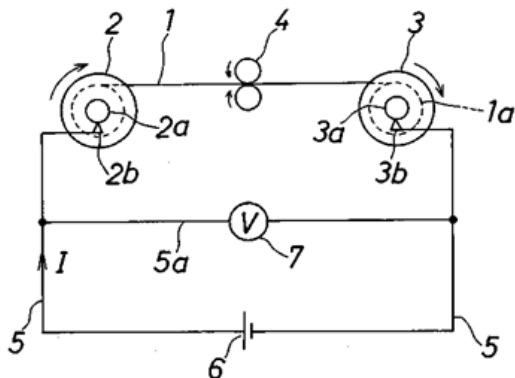
Measuring electrical characteristics while winding

Definition statement

This place covers:

Processes or apparatus for winding coils while measuring electrical characteristics, e.g. resistance, inductance or capacitance.

The figure below is an example of material classified in this subgroup. In the figure, the existence of an electrical short circuit is detected by measuring voltage during winding.



H01F 41/14

for applying magnetic films to substrates (covering metals, or materials with metals, in general [C23C](#); manufacturing record carriers [G11B 5/84](#))

Definition statement

This place covers:

Thin films deposition methods not provided in subgroups below.

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 ([H01F 41/18](#) - [H01F 41/24](#) take precedence; thick magnetic films [H01F 1/0027](#))}

Definition statement

This place covers:

Deposition methods and apparatus for forming thick magnetic films, usually performed by macroscopic methods.

H01F 41/18

by cathode sputtering

Definition statement

This place covers:

Deposition methods and apparatus for forming thin magnetic films characterised by deposition methods.

H01F 41/22

Heat treatment; Thermal decomposition; Chemical vapour deposition

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Coating by evaporation or sputtering	C23C 14/00
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H01F 41/24

from liquids

Definition statement

This place covers:

Deposition from liquids.

[H01F 1/26](#) covers deposition from liquids using electric currents.

[H01F 1/28](#) covers deposition from liquids by liquid phase epitaxy.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electrodeposition	C25D 3/00 , C25D 5/00
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H01F 41/30

for applying nanostructures, e.g. by molecular beam epitaxy [MBE]

Definition statement

This place covers:

Deposition methods and apparatus for forming multilayered nanostructures, especially spin-exchange-coupled multilayers corresponding to product subgroups [H01F 10/324-H01F 10/3295](#), characterised by specific process steps leading to a specific change of properties of the grown superlattice ([H01F 41/303-H01F 41/304](#)) or to a given structure ([H01F 41/305-H01F 41/309](#)).

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Ion implantation	C23C 14/48
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H01F 41/32

for applying conductive, insulating or magnetic material on a magnetic film {, specially adapted for a thin magnetic film}

Definition statement

This place covers:

Deposition methods and apparatus for applying a single layer on a magnetic thin film characterised by specific process steps.

[H01F 41/34](#) covers deposition in patterns (i.e. using lithography).

References***Informative references***

Attention is drawn to the following places, which may be of interest for search:

Ion implantation	C23C 14/48
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Special rules of classification

Spin filters capping layers for TMR/GMR structures (products) are also classified within method subgroup [H01F 41/325](#).