ECLA EUROPEAN CLASSIFICATION

F16F SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION

[N: **WARNING** [C0802]

1. The following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups:

F16F3/07	covered by	F16F13/00
F16F9/24	covered by	F16F9/22
F16F9/40	covered by	F16F9/00 to F16F9/50
F16F9/508	covered by	F16F9/512
F16F11/00	covered by	F16F7/00, F16F9/00, F16F15/00
F16F13/12	covered by	F16F13/08

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Notes

1. This subclass covers:

- springs, shock-absorbers or vibration-dampers;
- their arrangement in, or adaptation for, particular apparatus if not provided for in the subclasses covering said apparatus.

2. This subclass does not cover inventions concerning the arrangement or adaptation of springs, shock-absorbers or vibration-dampers in, or for, particular apparatus, if provided for in the subclasses concerning the said apparatus, e.g.

A47C23/00 to A47C27/00	Spring mattresses [N: A61F2/00 Prostheses]
A63C5/075	Vibration dampers in skis
B60G	Vehicle suspensions
B60R19/24	Mounting of bumpers on vehicles
B61F	Rail vehicle suspensions
B61G11/00	Buffers for railway or tramway vehicles
B62D21/15	Vehicle chassis frames having impact absorbing means
B62J1/02	Resiliently mounted saddles on cycles
B62K21/08	Steering dampers
B63H21/30	Anti-vibration mounting of marine propulsion plant in ships
B64C25/58	Arrangement of shock-absorbers or springs in aeroplane alighting gear
B65D81/02	Containers, packing elements or packages with shock-absorbing means
D06F37/20	Resilient mountings in washing machines
D06F49/06	Resilient mountings in domestic spin-dryers [N: E04B1/98 Protection of buildings against vibrations or shocks]
E05D7/086	Braking devices structurally combined with hinges
F03G1/00	Spring motors [N: F16L3/20 Pipe or cable supports]
F21V15/04	Resilient mounting of lighting devices
F41A25/00	Gun cradles to permit recoil
F41B5/20	Vibration dampers for archery bows
G01D11/00	Indicating or recording in connection with measuring

G01G21/10 Weighing apparatus, e.g. arrangement of shock-absorbers in weighing apparatus
G04B Clocks, watches
G12B3/08 Damping of movements in instruments
G21C7/20 Disposition of shock-absorbing devices for displaceable control elements in nuclear reactors.
[N: H02G7/14 Arrangements or devices for damping mechanical oscillations of power lines]

[N: **Notes**
[C0307]

1. Mention of "steel" or "metal" in groups F16F, unless specific mention is made otherwise, should be seen in the light of the title of group F16F1/00, i.e. material having low internal friction. This normally includes composite materials such as fibre-reinforced plastics.

2. Mention of "rubber" or "plastics" in group F16F, unless specific mention is made otherwise, should be seen in the light of the title of group F16F1/36, i.e. material having high internal friction. This normally does NOT include composite materials such as fibre-reinforced plastics except in the case of groups F16F1/366 to F16F1/368A2 and F16F15/305.

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F16F1/00 **Springs** (working with fluid F16F5/00, F16F9/00)

F16F1/02 . made of steel or other material having low internal friction ([N: characterised by their special construction from fibre-reinforced plastics F16F1/366; spring units consisting of several springs F16F3/02; making springs from wire B21F35/00]); Wound, torsion, leaf, cup, ring or the like springs, the material of the spring not being relevant [C0804]

F16F1/02B . . [N: characterised by their composition, e.g. comprising materials providing for particular spring properties (composition and manufacture of clock or watch springs G04B1/14R)] [C0504]

F16F1/02B2 . . . [N: made of ceramic materials] [N0504]

F16F1/02D . . [N: Covers or coatings therefor (F16F1/24 takes precedence)] [C0305]

F16F1/02S . . [N: characterised by having a particular shape (F16F1/04, F16F1/14, F16F1/18, F16F1/32, F16F1/34 take precedence)] [C0504]

F16F1/02S2 . . . [N: Planar, e.g. in sheet form; leaf springs] [N0302] [C0708]

F16F1/02S4 . . . [N: cylindrical, with radial openings] [N0708]

F16F1/04 . . Wound springs [N: (making springs by coiling wire B21F3/00)] [C0804]

F16F1/04A . . . [N: with means for modifying the spring characteristics (F16F1/12, F16F3/06 take precedence; fluid regulation of coil spring characteristics in vehicle suspensions B60G17/027C)] [N0209] [C0708]

F16F1/04B . . . [N: characterised by the cross-section of the wire]

F16F1/04B2 . . . . [N: the cross-section varying with the wire length]

F16F1/04C . . . [N: Canted-coil springs] [N9610]

F16F1/04N . . . [N: with partial nesting of inner and outer coils (F16F3/04 takes precedence)]

N0804]

F16F1/04P . . . [N: characterised by varying pitch] [N9411]

F16F1/04W . . . [N: with undulations, e.g. wavy springs] [N0804]

F16F1/06 . . . with turns lying in cylindrical surfaces

F16F1/06R . . . . [N: characterised by loading of the coils in a radial direction (canted-coil springs F16F1/04C)] [N0302]

F16F1/08 . . . with turns lying in mainly conical surfaces, [N: i.e. characterised by varying diameter (F16F1/10 takes precedence)] [C0302]

F16F1/10 . . . Spiral springs with turns lying substantially in plane surfaces [N: (F16F1/32R2 takes precedence)] [C0504]

F16F1/12 . . . Attachments or mountings [N: (F16F1/04A, F16F13/02 take precedence; of combinations of vibration damper and mechanical spring for vehicle suspension units B60G15/02)] [C0307]

F16F1/12A . . . . [N: adjustable, e.g. to modify spring characteristics] [N0708]

F16F1/12C . . . . [N: where coils, e.g. end coils, of the spring are rigidly clamped or similarly fixed] [N9604]

F16F1/12D . . . . [N: characterised by the ends of the spring being specially adapted, e.g. to form an eye for engagement with a radial insert (F16F1/12C, F16F1/12N take precedence)] [N9604]

F16F1/12N . . . . [N: where the end coils of the spring engage an axial insert (F16F1/12P, F16F1/12T take precedence)] [N9604]

F16F1/12P . . . . [N: comprising an element between the end coil of the spring and the support proper, e.g. an elastomeric annulus (F16F1/13 takes precedence)] [N9604]

F16F1/12R . . . . [N: allowing rotation about axis of spring]

F16F1/12T . . . . [N: with motion-limiting means, e.g. with a full-length guide element or ball joint connections; with protective outer cover (F16F1/12A takes precedence)] [N9604] [C0708]

F16F1/13 . . . . comprising inserts and spacers between the windings for changing the mechanical or physical characteristics of the spring [N: (F16F1/12C takes precedence)] [C9604]

F16F1/14 . . Torsion springs consisting of bars or tubes

F16F1/14C . . . [N: with means for modifying the spring characteristics (fluid regulation of torsion spring characteristics in vehicle suspensions B60G17/027T)][N0307]

F16F1/16 . . . Attachments or mountings [N: (F16F1/14C takes precedence; mounting means for vehicle stabiliser bars B60G21/055B)] [C0804]

F16F1/18 . . Leaf springs [N: (planar springs in general F16F1/02S2; "Belleville"-type springs with generally radial arms F16F1/32R)] [C0305]

F16F1/18N . . . [N: with inter-engaging portions between leaves or between leaves and mountings, e.g. ridges, notches, ripples] [N9411]

F16F1/18S . . . [N: characterised by shape or design of individual leaves (F16F1/22 takes precedence)] [C9610]

F16F1/18S2 . . . . [N: shaped into an open profile, i.e. C- or U-shaped] [N0302] [C0504]

F16F1/20 . . . with layers, e.g. anti-friction layers, or with rollers between the leaves

F16F1/22 . . . with means for modifying the spring characteristic [N: (fluid regulation of leaf spring characteristics in vehicle suspensions B60G17/027D)] [C9711]

F16F1/24 . . . Lubrication; Covers, e.g. for retaining lubricant

F16F1/26 . . . Attachments or mountings ([N: F16F1/18N, F16F1/22] B60G11/10 take precedence) [C9711]

F16F1/28 . . . . comprising cylindrical metal pins pivoted in close-fitting sleeves

F16F1/30 . . . . comprising intermediate pieces made of rubber or similar elastic material

F16F1/32 . . Belleville-type springs (friction-clutch diaphragm springs F16D13/58C) [C9610]

F16F1/32A . . . [N: Snap-action springs]

F16F1/32R . . . [N: characterised by having tongues or arms directed in a generally radial direction, i.e. diaphragm-type springs] [N9702]

F16F1/32R2 . . . . [N: with a spiral-like appearance] [N0205]

F16F1/32W . . . [N: with undulations, e.g. wavy springs] [N9702]

F16F1/34 . . Ring springs, i.e. annular bodies deformed radially due to axial load

F16F1/36 . made of rubber or other material having high internal friction, [N: e.g. thermoplastic elastomers (spring units consisting of several springs F16F3/08)] [C0305]

F16F1/36B . . [N: characterised by their material (F16F1/362, F16F1/364, F16F1/366, F16F1/37 take precedence; composition of macromolecular compounds in general C08L)] [C0504]

F16F1/36B2 . . . [N: comprising magneto-rheological elastomers (MR), (magneto-rheological fluid dampers F16F9/53M)] [N0504] [C0708]

F16F1/36D . . [N: with means for modifying the spring characteristic (F16F1/371 takes precedence)] [C0209]

F16F1/362 . . made of steel wool, compressed hair, [N: woven or non-woven textile, or like materials] [C0708]

F16F1/364 . . made of cork, wood or like material

F16F1/366 . . made of fibre-reinforced plastics, [N: i.e. characterised by their special construction from such materials] [C0305]

[N: **Note**
Attention is drawn to notes following the subclass title regarding interpretation of the term "plastics" in groups F16F, in particular as regards the subject matter of groups F16F1/366 to F16F1/368A2.
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F16F1/366C . . . [N: Wound springs] [N0307]

F16F1/368 . . . Leaf springs

F16F1/368A . . . . [N: Attachments or mountings therefor]

F16F1/368A2 . . . . . [N: End mountings] [N9411]

F16F1/37 . . of foam-like material, [N: i.e. micro-cellular material], e.g. sponge rubber [N: (padded linings for vehicle interiors B60R21/04)] [C9601]

F16F1/371 . . characterised by inserts or auxiliary extension [N: or exterior] elements, e.g. for rigidification (F16F1/387 takes precedence; [N: non-embedded reinforcing elements for flexibly-walled air springs F16F9/04C]) [C0305]

F16F1/371B . . . [N: with external elements passively influencing spring stiffness, e.g. rings or hoops] [N9411] [C0307]

F16F1/371B2 . . . . [N: External elements such as covers or envelopes, that are flexible] [N0708]

F16F1/373 . . characterised by having a particular shape [N: (F16F9/58 takes precedence)] [C0001]

F16F1/373A . . . [N: having an annular or the like shape, e.g. grommet-type resilient mountings] [C0307]

F16F1/373A2 . . . . [N: Multi-part grommet-type resilient mountings] [N0209]

F16F1/373P . . . [N: Planar, e.g. in sheet form (vibration dampers comprising one or more constrained viscoelastic layers F16F9/30L)] [N0302]

F16F1/374 . . . having a spherical or the like shape [C9801]

F16F1/376 . . . having projections, studs, serrations or the like on at least one surface ([N: F16F1/38L], F16F1/387 take precedence) [C9601]

F16F1/377 . . . having holes or openings ([N: F16F1/37], F16F1/387 take precedence)

F16F1/379 . . characterised by arrangements for regulating the spring temperature, e.g. by cooling

F16F1/38 . . with a sleeve of elastic material between a rigid outer sleeve and a rigid inner sleeve or pin,[N: i.e. bushing-type (hydraulically-damped bushes F16F13/14; suppression of vibrations in rotating systems by making use of elastomeric spring members between rotating elements, driveline torque being transmitted therebetween F16F15/126, by making use of a dynamic damping mass attached to a rotating element by means of elastomeric springs F16F15/14; pivots per se F16C11/00; elastic or yielding bearings or bearing supports F16C27/00; parts of sliding-contact bearings, e.g. bushes F16C33/04)] [C0302]

F16F1/38B . . . [N: characterised by adaptations for particular modes of stressing] [C0305]

F16F1/38B2 . . . . [N: characterised by adaptations to counter axial forces (F16F1/393 takes precedence)] [N0305]

F16F1/38B4 . . . . [N: characterised by adaptations to counter torsional forces] [N0305]

F16F1/38D . . . [N: End stop features or buffering (F16F1/38B takes precedence)] [N0708]

F16F1/38L . . . [N: characterised by the sleeve of elastic material, e.g. having indentations or made of materials of different hardness (F16F1/38B, F16F1/387 take precedence)] [N9601] [C0307]

F16F1/38M . . . [N: Method of assembly, production or treatment; Mounting thereof (supports for pipes, cables or protective tubing F16L3/00)] [N9601] [C0302]

F16F1/38M2 . . . . [N: Mounting brackets therefor, e.g. stamped steel brackets; Restraining links] [N9907] [C0001]

F16F1/38M4 . . . . [N: Vulcanisation or gluing of interface between rigid and elastic sleeves] [N0708]

F16F1/38N . . . [N: characterised by the rigid sleeves or pin, e.g. of non-circular cross-section (F16F1/38B,F16F1/387 take precedence)] [N9601] [C0307]

F16F1/387 . . . comprising means for modifying the rigidity in particular directions [N: (spherical or conical sleeves F16F1/393)] [C9801]

F16F1/387H . . . . [N: having holes or openings] [N0009]

F16F1/387N . . . . [N: by means of inserts of more rigid material] [N0504]

F16F1/393 . . . with spherical or conical sleeves

F16F1/393C . . . . [N: Conical sleeves] [N0305]

F16F1/40 . . consisting of a stack of similar elements separated by non-elastic intermediate layers [N: (F16F9/30L takes precedence; laminated constructions to protect buildings against abnormal external influences, e.g. earthquakes, E04H9/02B2)] [C0001]

F16F1/40B . . . [N: characterised by the shape of the non-elastic interengaging parts between the elements]

F16F1/40L . . . [N: characterised by the shape of the elastic elements] [N9601]

F16F1/41 . . . the spring consisting of generally conically arranged elements [N: (if sleeve-like, i.e. a surface of revolution F16F1/393C)] [C0307]

F16F1/42 . . characterised by the mode of stressing [C0504]

[N: **Note**
[C0307] Classification of documents in groups F16F1/42 to F16F1/54, concerning the mode of stressing of elastomeric springs, is to be considered only when

classification in other subgroups of F16F1/36 would be unsuitable. Attention is drawn to the parallel scheme of indexing codes under R16F236/00.
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F16F1/42B . . . [N: the stressing resulting in flexion of the spring]

F16F1/42B1 . . . . [N: of membrane-type springs]

F16F1/42B2 . . . . [N: Radial flexion of ring-type springs]

F16F1/42B3 . . . . [N: of strip- or leg-type springs]

F16F1/44 . . . loaded mainly in compression

F16F1/44B . . . . [N: the spring material being contained in a generally closed space (F16F1/393 takes precedence)]

F16F1/46 . . . loaded mainly in tension

F16F1/48 . . . loaded mainly in torsion

F16F1/50 . . . loaded mainly in shear

F16F1/50C . . . . [N: Rotational shear]

F16F1/52 . . . loaded in combined stresses

F16F1/54 . . . . loaded in compression and shear

F16F1/54B . . . . . [N: Neidhart-type rubber springs (vehicle suspensions having Neidhart-type rubber springs B60G11/22C)]

F16F3/00 **Spring units consisting of several springs, e.g. for obtaining a desired spring characteristic** ([N: F16F1/32, F16F1/34, F16F7/14take precedence]; if including fluid springs F16F5/00, F16F13/00) [C0307]

[N: **Note**
In this group, vehicle leaf spring units, i.e. "packets" of individual leaves, are considered as a single spring
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F16F3/02 . with springs made of steel or of other material having low internal friction

F16F3/02L . . [N: composed only of leaf springs] [N0504]

F16F3/02N . . [N: to give a zero-spring rate characteristic] [N9601]

F16F3/04 . . composed only of wound springs

F16F3/06 . . . of which some are placed around other in such a way that they damp each other by mutual friction

F16F3/08 . with springs made of a material having high internal friction, e.g. rubber [N: (multi-part grommet-type resilient mountings F16F1/373A2)] [C0209]

F16F3/087 . . Units comprising several springs made of plastics or the like material (F16F1/40, [N: F16F1/54B] take precedence) [C9411]

F16F3/087B . . . [N: of the same material or the material not being specified]

F16F3/087B1 . . . . [N: and of the same shape]

F16F3/093 . . . the springs being of different materials, e.g. having different types of rubber [N: (F16F1/38L takes precedence)] [C9601]

F16F3/093B . . . . [N: and being of the same shape]

F16F3/10 . . combined with springs made of steel or other material having low internal friction

F16F3/12 . . . the steel spring being in contact with the rubber spring [N: (F16F1/12 takes

ecedence)] [C0305]

F16F5/00 **Liquid springs in which the liquid works as a spring by compression, e.g. combined with throttling action; Combinations of devices including liquid springs** [N: (dampers with solid or semi-solid material F16F9/30)] [C9601]

F16F6/00 **Magnetic springs;** [N: (magnetic spring arrangements for the suppression of vibration in systems F16F15/03)]**; Fluid magnetic springs,** [N: i.e. magnetic spring combined with a fluid] [C0307]

F16F6/00B . [N: using permanent magnets only] [N0205]

F16F7/00 **Vibration-dampers; Shock-absorbers** (using fluid F16F5/00, F16F9/00; specific for rotary systems F16F15/10; [N: belt tensioners F16H7/12]) [C0110]

F16F7/00B . [N: One-shot shock absorbers (using plastic deformation of members, e.g. using sacrificial, fibre-reinforced composite members F16F7/12)] [N9908] [C0305]

F16F7/00B4 . . [N: using textile means (safety belts or body harnesses incorporating energy absorbing means A62B35/04)] [N9908] [C0305]

F16F7/01 . using friction between loose particles, e.g. sand

F16F7/01A . . [N: the particles being spherical, cylindrical or the like]

F16F7/02 . with relatively-rotatable friction surfaces that are pressed together (F16F7/01 takes precedence; one of the members being a spring F16F13/02; [N: friction devices between relatively-movable parts of a hinge E05D11/08; braking devices for wings E05F5/00]) [C0009]

F16F7/02A . . [N: and characterised by damping force adjustment means]

F16F7/02A2 . . . [N: resulting in the damping effects being different according to direction of rotation]

F16F7/04 . . in the direction of the axis of rotation [N: (F16F7/02A takes precedence)]

F16F7/06 . . in a direction perpendicular or inclined to the axis of rotation [N: (F16F7/02A takes precedence)]

F16F7/06S . . . [N: where elements interengaging frictionally are in the shape of spiral bands] [N9411]

F16F7/08 . with friction surfaces rectilinearly movable along each other (F16F7/01 takes precedence; [N: one of the members being a spring F16F13/02]) [C0001]

F16F7/08A . . [N: and characterised by damping force adjustment means]

F16F7/08A2 . . . [N: resulting in the damping effects being different according to direction of movement]

F16F7/08S . . [N: Elastomeric surface effect dampers] [N0708]

F16F7/09 . . in dampers of the cylinder-and-piston type [C0504]

F16F7/09C . . . [N: frictional elements brought into engagement by movement along a surface oblique to the axis of the cylinder, e.g. interaction of wedge-shaped elements] [N0302]

F16F7/10 . using inertia effect (F16F13/10S, F16F13/22, F16F15/10, F16F15/22 take precedence; stabilising vehicle bodies by means of movable masses B62D37/04; protection of buildings against vibrations or shocks by mass dampers E04B1/98A;

angements or devices for damping mechanical oscillations of power lines H02G7/14) [C0708]

F16F7/10A . . [N: characterised by active control of the mass] [C0001]

F16F7/10A2 . . . [N: by electromagnetic means] [N9411]

F16F7/10A4 . . . [N: by fluid means] [N9411]

F16F7/10C . . [N: the linear oscillation movement being converted into a rotational movement of the inertia member, e.g. using a pivoted mass] [C0302]

F16F7/10D . . [N: the inertia-producing means being a constituent part of the system which is to be damped] [N9411] [C9604]

F16F7/10L . . [N: of movement of a liquid] [N0804]

F16F7/104 . . the inertia member being resiliently mounted [N: (F16F7/10C takes precedence)]

F16F7/108 . . . on plastics springs [C0305]

F16F7/112 . . . on fluid springs [C0708]

F16F7/116 . . . on metal springs [C0307]

F16F7/12 . using plastic deformation of members [N: (F16F9/30 takes precedence; yieldable means for mounting bumpers on vehicles B60R19/26; yieldable or collapsible steering columns B62D1/19B)] [C0307]

F16F7/12A . . [N: the members having a cellular, e.g. honeycomb, structure]

F16F7/12A2 . . . [N: characterised by corrugations, e.g. of rolled corrugated material] [N0107] [C0708]

F16F7/12B . . [N: Deformation involving a bending action, e.g. strap moving through multiple rollers, folding of members (F16F7/12F, F16F7/12S take precedence)] [C0504]

F16F7/12C . . [N: characterised by their special construction from fibre-reinforced plastics] [N0305]

F16F7/12F . . [N: Units with a telescopic-like action as one member moves into, or out of a second member (F16F7/12C, F16F7/12G, F16F7/12S take precedence)] [C0504]

F16F7/12F2 . . . [N: against the action of shear pins; one member having protuberances, e.g. dimples, ball bearings which cause the other member to deform] [N0305]

F16F7/12G . . [N: by a blade element cutting or tearing into a quantity of material; Pultrusion of a filling material] [C9603]

F16F7/12S . . [N: characterised by the members, e.g. a flat strap, yielding through stretching, pulling apart] [N0305]

F16F7/14 . of cable support type, i.e. frictionally-engaged loop-forming cables

F16F9/00 **Springs, vibration-dampers, shock-absorbers, or similarly-constructed movement-dampers using a fluid or the equivalent as damping medium** (F16F5/00 takes precedence; connection of valves to inflatable elastic bodies B60C29/00; [N: braking devices, stops or buffers for wing-operating appliances E05F3/00, E05F5/00]) [C9907]

F16F9/00C . [N: Dampers characterised by having pressure absorbing means other than gas, e.g. sponge rubber]

F16F9/00D . [N: characterised by the nature of the damping medium, e.g. biodegradable (variable viscosity damping adjustment F16F9/53)] [C9908]

F16F9/02 . using gas only [N: or vacuum (F16F9/00D takes precedence)]

F16F9/02B . . [N: Telescopic (F16F9/04 takes precedence)] [C9907]

F16F9/02B2 . . . [N: Mono-tubular units (F16F9/02B3, F16F9/02B4, F16F9/02B5 take precedence)] [C0001]

F16F9/02B3 . . . [N: characterised by the piston construction]

F16F9/02B4 . . . [N: characterised by having a hollow piston rod]

F16F9/02B5 . . . [N: Means for adjusting the length of, or for locking, the spring or dampers] [C9907]

F16F9/02B5B . . . . [N: mechanically lockable, e.g. by use of friction collar (mechanical locking of extensible devices for holding wings E05C17/30)] [C0001]

F16F9/02B5D . . . . [N: characterised by actuation means, e.g. manually-operated lever arrangement (F16F9/02B5B takes precedence)] [N9702]

F16F9/02B5P . . . . [N: with control rod extending through the piston rod into the piston] [N0001]

F16F9/02B6 . . . [N: Details]

F16F9/02B6L . . . . [N: electrical, e.g. connections or contacts] [N9506]

F16F9/04 . . in a chamber with a flexible wall [N: (producing hollow articles of plastics, e.g. air bellows, B29D22/00)] [C0001]

F16F9/04A . . . [N: characterised by the wall structure]

F16F9/04B . . . [N: having a particular shape, e.g. annular, spherical, tube-like (F16F9/05 takes precedence)] [C9908]

F16F9/04B2 . . . . [N: toroidal] [N9710]

F16F9/04C . . . [N: characterised by being contained in a generally closed space] [C0504]

F16F9/04D . . . [N: characterised by intermediate rings or other not embedded reinforcing elements (wall structure F16F9/04A)]

F16F9/04F . . . [N: characterised by the assembling method or by the mounting arrangement, e.g. mounting of the membrane (F16F9/04A, F16F9/04D take precedence)]

F16F9/04F2 . . . . [N: with separate crimping rings] [N0504]

F16F9/04G . . . [N: characterised by comprising a damping device (with plastic deformation of members F16F7/12; delay devices or arrangements F15B21/10)] [C9908]

F16F9/04G1 . . . . [N: provided in an opening to the exterior atmosphere]

F16F9/04H . . . [N: multi-chamber units (F16F9/04G, F16F9/05 take precedence)] [C9908]

F16F9/05 . . . the flexible wall being of the rolling diaphragm type [C0504]

F16F9/05B . . . . [N: characterised by the bumper] [N0009]

F16F9/05D . . . . [N: having a double diaphragm construction] [N0307]

F16F9/05P . . . . [N: characterised by the piston] [N0009]

F16F9/06 . using both gas and liquid [N: (F16F9/48P take precedence; self-pumping fluid springs B60G17/044)] [C9907]

F16F9/06B . . [N: Mono-tubular units] [C0708]

F16F9/06C . . [N: Bi-tubular units] [C0708]

F16F9/06D . . [N: comprising a hollow piston rod] [C0708]

F16F9/06G . . [N: Units characterised by the location or shape of the expansion chamber (F16F9/06P, F16F9/08 take precedence)] [C9908]

F16F9/06G2 . . . [N: Expansion chamber provided on the upper or lower end of a damper, separately there from or laterally on the damper] [N0708]

F16F9/06H . . [N: Units characterised by the partition, baffle or like element (F16F9/06P, F16F9/08 take precedence)] [C9908]

F16F9/06H2 . . . [N: Partitions of the piston type, e.g. sliding pistons]

F16F9/06P . . [N: where the throttling of a gas flow provides damping action] [N9908]

F16F9/08 . . [N: where gas is] in a chamber with a flexible wall [N: (pressurised fluid system accumulators per se F15B1/04)] [C9908]

F16F9/08H . . . [N: being of the fluid displacement type, i.e. the piston not comprising damping arrangements (F16F9/096 takes precedence)]

F16F9/08K . . . [N: characterised by the hydropneumatic accumulator]

F16F9/084 . . . comprising a gas spring contained within a flexible wall, the wall not being in contact with the damping fluid, i.e. mounted externally on the damper cylinder

F16F9/088 . . . comprising a gas spring with a flexible wall provided within the cylinder on the piston rod of a monotubular damper or within the inner tube of a bitubular damper

F16F9/092 . . . comprising a gas spring with a flexible wall provided between the tubes of a bitubular damper

F16F9/096 . . . comprising a hydropneumatic accumulator of the membrane type provided on the upper or the lower end of a damper or separately from or laterally on the damper [N: (F16F9/088 takes precedence)] [C0001]

F16F9/10 . using liquid only; using a fluid of which the nature is immaterial

F16F9/10H . . [N: Devices with one or more members moving linearly to and fro in chambers, any throttling effect being immaterial, i.e. damping by viscous shear effect only (F16F9/53 takes precedence)] [N9907] [C0009]

F16F9/10S . . [N: Squeeze-tube devices] [N9411]

F16F9/12 . . Devices with one or more rotary vanes turning in the fluid any throttling effect being immaterial, [N: i.e. damping by viscous shear effect only ([N: F16F9/53 takes precedence]; pivoting supports for apparatus or articles placed on stands or trestles F16M11/06)] [C0205]

F16F9/12A . . . [N: characterised by adjustment means] [N0110]

F16F9/14 . . Devices with one or more members, e.g. pistons, vanes, moving to and fro in chambers and using throttling effect

F16F9/14B . . . [N: involving only rotary movement of the effective parts (wing closers or openers with fluid brakes of the rotary type E05F3/14)] [C0106]

F16F9/16 . . . involving only straight-line movement of the effective parts [N: (wing closers or openers with liquid piston brakes E05F3/04)] [C0106]

F16F9/16D . . . . [N: with two or more cylinders in line, i.e. in series connection (F16F9/26 takes precedence)] [N0504]

F16F9/18 . . . . with a closed cylinder and a piston separating two or more working spaces therein

F16F9/18D . . . . . [N: comprising a hollow piston rod] [N0001]

F16F9/18T . . . . . [N: Bitubular units (where compression of gas leads to a clear spring action F16F9/06C)] [N9506] [C0504]

F16F9/18T2 . . . . . [N: with uni-directional flow of damping fluid through the valves] [N0107]

F16F9/19 . . . . . with a single cylinder [N: and of single-tube type] [C9506]

F16F9/20 . . . . . with the piston-rod extending through both ends of the cylinder, [N: e.g. constant-volume dampers] [C9905]

F16F9/22 . . . . with one or more cylinders each having a single working space closed by a piston or plunger

F16F9/26 . . . . . with two cylinders in line and with the two pistons or plungers connected

together

F16F9/28 . . . . . with two parallel cylinders and with the two pistons or plungers connected together

F16F9/28R . . . . . [N: by a rocker arm] [N0708]

F16F9/30 . with solid or semi-solid material, e.g. pasty masses, as damping medium [N: (in devices where rotary elements are damped by viscous shear effect only, any throttling effect being immaterial F16F9/12; where members moving with a rotating system are being damped F16F15/16)] [C0302]

F16F9/30C . . [N: the damper being of the telescopic type]

F16F9/30L . . [N: of the constrained layer type, i.e. comprising one or more constrained viscoelastic layers] [N0001]

F16F9/32 . Details

F16F9/32B . . [N: Constructional features (F16F9/34 to F16F9/50 take precedence; assembly or repair F16F9/32D)] [C9509]

F16F9/32B2 . . . [N: of pistons (F16F9/02B3 and F16F9/36 take precedence; throttling passages in or on piston body F16F9/34A)] [C0209]

F16F9/32B3 . . . [N: of piston rods]

F16F9/32B4 . . . [N: of connections between pistons and piston rods]

F16F9/32B5 . . . [N: of cylinders (F16F9/48C takes precedence)] [C9601]

F16F9/32B5B . . . . [N: of cylinder ends, e.g. caps] [C9509]

F16F9/32B5D . . . . [N: for attachment of valve units]

F16F9/32B5T . . . . [N: in twin-tube type devices] [N0107] [C0504]

F16F9/32C . . [N: Arrangements for indicating, e.g. fluid level; Arrangements for checking dampers (F16F9/32S takes precedence; testing of vehicle damping G01M17/04)] [C0708]

F16F9/32D . . [N: Assembly or repair] [C9509]

F16F9/32F . . [N: for lubrication (lubricating per se F16N)]

F16F9/32G . . [N: for filtering (filters per se B01D)]

F16F9/32S . . [N: Sensor arrangements] [N0110]

F16F9/34 . . Special valve constructions ([N: F16F9/44, F16F9/50 take precedence; filtering details F16F9/32G]; valves in general F16K); Shape or construction of throttling passages [C9908]

F16F9/34A . . . [N: Throttling passages in or on piston body, e.g. slots (F16F9/344, F16F9/348A take precedence)] [N9506] [C0302]

F16F9/34N . . . [N: comprising noise-reducing or like features, e.g. screens (F16F9/34P takes precedence)]

F16F9/34P . . . [N: characterised by comprising plastics, elastomeric or porous elements] [C9509]

F16F9/342 . . . Throttling passages operating with metering pins [N: (F16F9/48P takes precedence)] [C0209]

F16F9/344 . . . Vortex flow passages

F16F9/346 . . . Throttling passages in the form of slots arranged in cylinder walls

F16F9/346S . . . . [N: Slots having a variable section along their length] [N9702]

F16F9/348 . . . Throttling passages in the form of annular discs [N: or other plate-like elements which may or may not have a spring action], operating in opposite directions [N: or singly, e.g. annular discs positioned on top of the valve or piston body

F16F9/34N, F16F9/34P take precedence)] [C0302]

F16F9/348A . . . . [N: characterised by shape or construction of throttling passages in piston (F16F9/344 takes precedence)] [N0302]

F16F9/348B . . . . [N: the annular discs being incorporated within the valve or piston body (F16F9/348D, F16F9/348G take precedence)] [C9506]

F16F9/348D . . . . [N: characterised by features of the annular discs per se, singularly or in combination] [C0302]

F16F9/348G . . . . [N: characterised by features of supporting elements intended to guide or limit the movement of the annular discs (F16F9/348S takes precedence)] [C0302]

F16F9/348G2 . . . . . [N: with spacers or spacing rings] [N0302] [C0708]

F16F9/348S . . . . [N: characterised by features intended to affect valve bias or pre-stress] [N0804]

F16F9/36 . . Special sealings, including sealings or guides for piston-rods ([N: F16F9/32B5D, F16F9/348G take precedence; arrangements for filling via piston rod sealing or guiding means F16F9/43A]; sealing of moving parts in general F16J15/16 to F16J15/56) [C9708]

F16F9/36B . . . [N: Sealings of the bellows-type] [N9411]

F16F9/36C . . . [N: Combination of sealing and guide arrangements for piston rods (F16F9/36B, F16F9/36D take precedence)] [N9411]

F16F9/36C1 . . . . [N: the guide being mounted between the piston and the sealing, enabling lubrication of the guide] [N9411]

F16F9/36C2 . . . . [N: of multi-tube dampers] [N9411]

F16F9/36D . . . [N: the sealing arrangement having a pressurised chamber separated from the damping medium] [N9411]

F16F9/36G . . . [N: functioning as guide only, e.g. bushings]

F16F9/36G2 . . . . [N: allowing misalignment of the piston rod] [N9411]

F16F9/36P . . . [N: Sealings in pistons] [N9411] [C0205]

F16F9/36Q . . . [N: Sealings for elements other than pistons or piston rods, e.g. valves] [N9411]

F16F9/38 . . Covers for protection or appearance

F16F9/42 . . Cooling arrangements

F16F9/43 . . Filling [N: or drainage] arrangements, e.g. for supply of gas [N: (filling vessels with, or discharging from vessels, compressed, liquefied, or solidified gases F17C)] [C9907]

F16F9/43A . . . [N: via piston rod sealing or guiding means] [N9708]

F16F9/43C . . . [N: via opening in cylinder wall (F16F9/43A takes precedence)] [N9708]

F16F9/43D . . . [N: Drainage arrangements] [N9708]

F16F9/44 . . Means on or in the damper for manual or non-automatic adjustment; Such means combined with temperature correction (F16F9/53, [N: F16F13/26] take precedence; temperature correction only F16F9/52)

F16F9/44N . . . [N: manually adjusted while the damper is fully retracted or extended in a non-operational mode by rotating mechanical means that have engaged between the piston and one end of the cylinder] [N9506]

F16F9/44P . . . [N: Adjustment of valve bias or pre-stress (F16F9/44N takes precedence)] [N9905] [C9908]

F16F9/46 . . . allowing control from a distance, [N: i.e. location of means for control input being remote from site of valves, e.g. on damper external wall (attachment of valve units to cylinders F16F9/32B5D)] [C9509]

F16F9/46A . . . . [N: characterised by actuation means]

F16F9/46A2 . . . . . [N: Rotary actuation means]

F16F9/46L . . . . [N: characterised by electrical connections] [N9411]

F16F9/46P . . . . [N: Control of valve bias or pre-stress, e.g. electromagnetically (F16F9/46S takes precedence)] [C9506]

F16F9/46S . . . . [N: using servo control, the servo pressure being created by the flow of damping fluid, e.g. controlling pressure in a chamber downstream of a pilot passage (self-adjustment of damping F16F9/50)] [C0001]

F16F9/46T . . . . [N: Throttling control, i.e. regulation of flow passage geometry (F16F9/46P, F16F9/46S take precedence)] [C9506]

F16F9/46T2 . . . . . [N: using rotary valves]

F16F9/46T2A . . . . . [N: controlling at least one bypass to main flow path]

F16F9/46T4 . . . . . [N: Valves incorporated in the piston (F16F9/46T2 takes precedence)] [N0708]

F16F9/48 . . Arrangements for providing different damping effects at different parts of the stroke ([N: F16F9/346, F16F9/516], F16F9/53 take precedence) [C9702]

F16F9/48C . . . [N: characterised by giving a particular shape to the cylinder, e.g. conical] [N9601] [C9702]

F16F9/48P . . . [N: comprising a pin or stem co-operating with an aperture, e.g. a cylinder-mounted stem co-operating with a hollow piston rod] [C0209]

F16F9/49 . . . Stops limiting fluid passage, e.g. hydraulic stops [N: or elastomeric elements inside the cylinder which contribute to changes in fluid damping (fluid-actuated displacement devices with means for accelerating or decelerating the stroke F15B15/22)] [C0205]

F16F9/50 . . Special means providing automatic damping adjustment, [N: i.e. self-adjustment of damping by particular sliding movements of a valve element, other than flexions or displacement of valve discs] (F16F9/53 takes precedence); [N: Special means providing self-adjustment of spring characteristics] [C9610]

F16F9/504 . . . Inertia, [N: i.e. acceleration,] -sensitive means [C0209]

F16F9/512 . . . Means responsive to load action, [N: i.e. static load] on the damper or [N: dynamic] fluid pressure [N: changes] in the damper, [N: e.g. due to changes in velocity (F16F9/504, F16F9/516 take precedence; non-automatic damper adjustment from a distance using servo control, the servo pressure being created by the flow of damping fluid F16F9/46S; self-pumping fluid springs in vehicle suspensions B60G17/044)] [C0001]

F16F9/512A . . . . [N: responsive to the static or steady-state load on the damper] [N9506] [C9601]

F16F9/512P . . . . [N: Piston, or piston-like valve elements (F16F9/504 takes precedence)] [N9601] [C9708]

F16F9/516 . . . resulting in the damping effects during contraction being different from the damping effects during extension, [N: i.e. responsive to the direction of movement (F16F9/504 takes precedence)] [C9411]

F16F9/516B . . . . [N: by use of spherical valve elements or like free-moving bodies] [N9509]

F16F9/52 . . . in case of change of temperature ([N: F16F9/00C takes precedence;] combined with external adjustment F16F9/44)

F16F9/52B . . . . [N: with coil or spiral of bimetallic elements being used to change flow cross-section] [N9411]

F16F9/52S . . . . [N: Self-adjustment of fluid springs] [N0106]

F16F9/53 . . Means for adjusting damping characteristics by varying fluid viscosity, e.g. electromagnetically [N: (F16F13/30 takes precedence; brakes comprising a

medium with electrically or magnetically controlled friction F16D63/00B4; electrorheological fluids per se C10M171/00B; magnetorheological fluids per se H01F1/44R)] [C0009]

F16F9/53L . . . [N: Electrorheological (ER) fluid dampers] [N9601]

F16F9/53M . . . [N: Magnetorheological (MR) fluid dampers (springs comprising magnetorheological (MR) elastomers F16F1/36B2)] [N9601] [C0708]

F16F9/53M2 . . . . [N: specially adapted valves therefor] [N0302]

F16F9/54 . . Arrangements for attachment [N: (grommet-type rubber mounting springs per se F16F1/373A; construction of cylinder ends F16F9/32B5B; attachments to vehicles B60G13/00B, B60G15/00)] [C9905]

F16F9/56 . . Means for adjusting the length of, or for locking, the spring or damper, e.g. at the end of the stroke [N: (F16F9/50 takes precedence; for telescopic gas springs or dampers F16F9/02B5; vehicle suspension locking arrangements B60G17/005)] [N9601] [C0001]

F16F9/58 . . Stroke limiting stops, e.g. arranged on the piston rod outside the cylinder (F16F9/49 takes precedence)

F16F9/58N . . . [N: within the cylinder, in contact with working fluid] [N0001] [C0107]

F16F13/00 **Units comprising springs of the non-fluid type as well as vibration-dampers, shock-absorbers, or fluid springs** (F16F5/00, [N: F16F6/00, F16F9/00C] take precedence) [C0305]

F16F13/00F . [N: comprising at least one fluid spring (F16F13/00W, F16F13/02, F16F13/04 take precedence)]

F16F13/00W . [N: comprising both a wound spring and a damper, e.g. a friction damper] [N0305]

F16F13/00W2 . . [N: the damper being a fluid damper] [N0305]

F16F13/02 . damping by frictional contact between the spring and braking means (frictionally coacting wound springs F16F3/06)

F16F13/04 . comprising both a plastics spring and a damper, e.g. a friction damper

F16F13/06 . . the damper being a fluid damper, e.g. the plastics spring not forming a part of the wall of the fluid chamber of the damper (F16F13/26 takes precedence)

F16F13/08 . . . the plastics spring forming at least a part of the wall of the fluid chamber of the damper (F16F13/20 to F16F13/24 take precedence)

F16F13/08S . . . . [N: characterised by features of plastics springs; Attachment arrangements] [N0504]

F16F13/10 . . . . the wall being at least in part formed by a flexible membrane or the like (F16F13/14 to F16F13/18 take precedence) [C0001]

F16F13/10B . . . . . [N: characterised by buffering features or stoppers] [N9905] [C0009]

F16F13/10D . . . . . [N: characterised by features of flexible walls of equilibration chambers; decoupling or self-tuning means] [N0708]

F16F13/10M . . . . . [N: characterised by method of assembly, production or treatment] [N9708] [C0708]

F16F13/10P . . . . . [N: characterised by features of partitions between two working chambers] [N9708]

F16F13/10P2 . . . . . [N: Design of constituent elastomeric parts, e.g. decoupling valve elements, or of immediate abutments therefor, e.g. cages] [N9708]

F16F13/10P4 . . . . . [N: Passage design between working chambers] [N9708]

F16F13/10S . . . . . [N: characterised by features of plastics springs, e.g. attachment arrangements (F16F13/18 takes precedence)] [N9708]

F16F13/14 . . . . Units of the bushing type, [N: i.e. loaded predominantly radially (bushes F16F1/38; mounting brackets therefor F16F1/38M2)] [C0009]

F16F13/14B . . . . . [N: characterised by buffering features or stoppers] [N9711]

F16F13/14C . . . . . [N: characterised by the location or shape of the equilibration chamber] [N9711] [C0804]

F16F13/14D . . . . . [N: characterised by features of flexible walls of equilibration chambers; decoupling or self-tuning means] [N9711] [C0708]

F16F13/14F . . . . . [N: with free- or virtually free-floating members] [N9411]

F16F13/14M . . . . . [N: characterised by method of assembly, production or treatment] [N0708]

F16F13/14M2 . . . . . [N: Sealing of units] [N0708]

F16F13/14P . . . . . [N: characterised by features of passages between working chambers] [N9711]

F16F13/14P2 . . . . . [N: Valve elements to cope with over-pressure, e.g. lips] [N0302]

F16F13/14S . . . . . [N: characterised by features of plastic springs, e.g. presence of cavities or stiffeners; characterised by features of flexible walls of equilibration chambers, i.e. membranes] [N9711] [C0305]

F16F13/14T . . . . . [N: Multiple bushings connected together; Restraining links] [N9711] [C0001]

F16F13/16 . . . . . specially adapted for receiving axial loads [N: (F16F13/14F takes precedence)] [C9506]

F16F13/18 . . . . characterised by the location or the shape of the equilibration chamber, e.g. the equilibration chamber, surrounding the plastics spring or being annular (F16F13/14C takes precedence) [C0804]

F16F13/20 . . . characterised by comprising also a pneumatic spring (F16F13/22, [N: F16F13/26] take precedence) [C9411]

F16F13/22 . . . characterised by comprising also a dynamic damper; dampers using inertia effect per se F16F7/10 [C0708]

F16F13/24 . . . the central part of the unit being supported by one element and both extremities of the unit being supported by a single other element, i.e. double acting mounting

F16F13/26 . . characterised by adjusting or regulating devices responsive to exterior conditions [N: (F16F13/10B takes precedence)] [C9905]

F16F13/26A . . . [N: changing geometry of passages between working and equilibration chambers, e.g. cross-sectional area or length (F16F13/28 takes precedence)] [C0108]

F16F13/26B . . . [N: comprising means for acting dynamically on the walls bounding a working chamber] [C0708]

F16F13/26P . . . [N: comprising means for acting dynamically on the walls bounding a passage between working and equilibration chambers] [N0708]

F16F13/26S . . . [N: comprising means for acting dynamically on the walls bounding an equilibration chamber(F16F13/26Btake precedence)][N9905][C0708]

F16F13/28 . . . specially adapted for units of the bushing type (F16F13/30 takes precedence) [C9905]

F16F13/30 . . . comprising means for varying fluid viscosity, e.g. of magnetic or electrorheological fluids

F16F13/30M . . . . [N: magnetorheological] [N9708]

F16F15/00 **Suppression of vibrations in systems** ([N: damping of non-rotary systems using inertia effect F16F7/10; prevention or isolation of vibrations in machine tools B23Q11/00D; suppression of driveline vibrations in hybrid vehicle transmissions B60K6/04B]; vehicle seat suspension devices B60N2/50; [N: methods or devices for protecting against, or damping of, acoustic waves, e.g. sound G10K11/16])**; Means or arrangements for avoiding or reducing out-of-balance forces, e.g. due to motion** ([N: vibration absorbing or balancing means for aircraft propellers B64C11/00L, for rotorcraft rotors B64C27/00B]; testing static and dynamic balance of machines or structures G01M1/00) [C0708]

F16F15/00B . [N: characterised by the control method or circuitry (control of mechanical oscillations per se G05D19/00)] [N0708]

F16F15/00P . [N: using electro- or magnetostrictive actuation means (generating of mechanical vibrations operating with electrostriction B06B1/06, with magnetostriction B06B1/08; vehicle suspension arrangements characterised by use of piezo-electric elements B60G17/015P; piezo-electric, electrostrictive and magnetostrictive devices per se H01L41/00)] [C0302]

F16F15/00P2 . . [N: Piezo-electric elements being placed under pre-constraint, e.g. placed under compression] [N0708]

F16F15/02 . Suppression of vibrations of non-rotating, e.g. reciprocating systems; Suppression of vibrations of rotating systems by use of members not moving with the rotating systems ([N: F16F15/00P takes precedence]; layered products B32B; suppression of vibration in ships B63; [N: relieving load on bearings, using magnetic means F16C39/06]) [C0302]

F16F15/02B . . [N: Decoupling of vibrations by means of point-of-contact supports, e.g. ball bearings] [N0504]

F16F15/02D . . [N: using dampers and springs in combination] [C9411]

F16F15/023 . . using fluid means

F16F15/023G . . . [N: with at least one gas spring (F16F15/027 takes precedence)]

F16F15/023R . . . [N: where a rotating member is in contact with fluid (rotary viscous dampers per se F16F9/12; suppression of vibrations in rotating systems containing a fluid F16F15/16)] [C0504]

F16F15/023S . . . [N: involving squeeze-film damping] [C9506]

F16F15/027 . . . comprising control arrangements [N: (F16F15/023S takes precedence)] [C9411]

F16F15/027S . . . . [N: Control of stiffness] [C9908]

F16F15/03 . . using [N: magnetic or] electromagnetic means (F16F9/53, [N: F16F15/00P] take precedence)

F16F15/03D . . . [N: by use of eddy or induced-current damping (dynamo-electric brakes of the eddy-current type H02K49/04B)] [N9411] [C0209]

F16F15/04 . . using elastic means (single elements or their attachment F16F1/00 to F16F13/00); [N: (F16F15/023, F16F15/03 take precedence)]

F16F15/04B . . . [N: acting on a cam follower]

F16F15/04C . . . [N: using combinations of springs of different kinds (F16F15/08M takes precedence)] [C9604]

F16F15/06 . . . with metal springs (with rubber springs also F16F15/08) [C0305]

F16F15/06D . . . . [N: with bars or tubes used as torsional elements]

F16F15/067 . . . . using only wound springs

F16F15/073 . . . . using only leaf springs

F16F15/08 . . . with rubber springs [N: (grommet- or bushing-type resilient mountings F16F1/373A, F16F1/38); with springs made of rubber and metal (arrangement of internal-combustion or jet-propulsion units B60K5/12; mounting of propulsion plants on vessels B63H21/30; mounting of vehicle drivers` cabs B62D33/06C)] [C0305]

F16F15/08M . . . . [N: Use of both rubber and metal springs] [N9604] [C9610]

F16F15/10 . Suppression of vibrations in rotating systems by making use of members moving with the system (by balancing F16F15/22; [N: yielding couplings F16D3/00]; with flywheels acting variably or intermittently F16H; [N: construction providing resilience or vibration-damping for gear elements F16H55/14])

F16F15/12 . . using elastic members or friction-damping members, e.g. between a rotating shaft and a gyratory mass mounted thereon ([N: F16F15/14], F16F15/16 take precedence) [C0302]

F16F15/12A . . . [N: for damping of axial or radial, i.e. non-torsional vibrations (F16F15/131A takes precedence)] [C9908]

F16F15/12L . . . [N: the damping action being at least partially controlled by centrifugal masses (F16F15/131L takes precedence)] [N9411] [C9908]

F16F15/12M . . . [N: characterised by manufacturing, e.g. assembling or testing procedures for the damper units (F16F15/131M takes precedence)] [C9908]

F16F15/12P . . . [N: with a kinematic mechanism or gear system (F16F15/12L, F16F15/131P take precedence)] [N9702] [C0106]

F16F15/12P1 . . . . [N: with a kinematic mechanism, i.e. linkages, levers] [N9702]

F16F15/12P2 . . . . [N: with a planetary gear system] [N9702]

F16F15/12S . . . [N: characterised by the supporting arrangement of the damper unit (F16F15/123P, F16F15/131S take precedence)] [C0804]

F16F15/12S2 . . . . [N: Bearing arrangements] [N0804]

F16F15/12S2S . . . . . [N: comprising sliding bearings] [N0804]

F16F15/121 . . . using springs as elastic members, e.g. metallic springs [N: (F16F15/133 takes precedence)] [C9908]

F16F15/121C . . . . [N: C-shaped springs] [N9702]

F16F15/121C1 . . . . . [N: disposed around axis of rotation] [N9702]

F16F15/121D . . . . [N: Spiral springs, e.g. lying in one plane, around axis of rotation] [N9702]

F16F15/121F . . . . [N: Folded springs, i.e. made of band-like material folded in an enclosing space] [N9702]

F16F15/121L . . . . [N: Leaf springs, e.g. radially extending] [N9702]

F16F15/121T . . . . [N: Torsional springs, e.g. torsion bar or torsionally-loaded coil springs] [N9702]

F16F15/121V . . . . [N: Motion-limiting means, e.g. means for locking the spring unit in pre-defined positions (F16F15/12L, F16F15/133V take precedence)] [N9702] [C0504]

F16F15/121V3 . . . . . [N: by means of spring-loaded radially arranged locking means] [N9702]

F16F15/121V5 . . . . . [N: by means of spring-loaded axially arranged locking means] [N9702]

F16F15/123 . . . . Wound springs [N: (F16F15/121D, F16F15/121T, F16F15/127 take precedence)] [C0305]

F16F15/123B . . . . . [N: Radially mounted springs] [N9702]

F16F15/123D . . . . . [N: characterised by the dimension or shape of spring-containing windows] [N9702]

F16F15/123M . . . . . [N: characterised by the spring mounting (F16F15/123B, F16F15/123D

take precedence)] [N9702]

F16F15/123M1 . . . . . [N: End-caps for springs] [N9702]

F16F15/123M1B . . . . . {7 dots} [N: having internal abutment means] [N9702]

F16F15/123M3 . . . . . [N: Additional guiding means for springs, e.g. for support along the body of springs that extend circumferentially over a significant length] [N9702] [C9908]

F16F15/123M5 . . . . . [N: Set of springs, e.g. springs within springs] [N9702]

F16F15/123N . . . . . [N: Combinations of dampers, e.g. with multiple plates, multiple spring sets, i.e. complex configurations] [N9702] [C0504]

F16F15/123N2 . . . . . [N: resulting in a staged spring characteristic, e.g. with multiple intermediate plates] [N9702] [C0110]

F16F15/123N2D . . . . . {7 dots} [N: acting on multiple sets of springs] [N9702]

F16F15/123N2D2 . . . . . {8 dots} [N: the sets of springs being arranged at substantially the same radius] [N9702]

F16F15/123P . . . . . [N: with pre-damper, i.e. additional set of springs between flange of main damper and hub] [C9603]

F16F15/123P5 . . . . . [N: Pre-damper cage construction] [N9702]

F16F15/123P9 . . . . . [N: pre-damper springs are of non-wound type, e.g. leaf springs] [N0001]

F16F15/124 . . . . Elastomeric springs (F16F15/123, [N: F16F15/127] take precedence) [C9907]

F16F15/124T . . . . . [N: Elastic elements arranged between substantially-radial walls of two parts rotatable with respect to each other, e.g. between engaging teeth] [N0708]

F16F15/126 . . . . . consisting of at least one annular element surrounding the axis of rotation [C9711]

F16F15/127 . . . . using plastics springs combined with other types of springs

F16F15/129 . . . characterised by friction-damping means ([N: F16F15/12L, F16F15/123P], F16F15/131 take precedence) [C0001]

F16F15/129A . . . . [N: characterised by arrangements for axially clamping or positioning or otherwise influencing the frictional plates] [N9411]

F16F15/129C . . . . [N: characterised by means for interconnecting driven plates and retainer, cover plates] [C9908]

F16F15/129L . . . . [N: Overload protection, i.e. means for limiting torque] [N0302]

F16F15/131 . . . the rotating system comprising two or more gyratory masses [C0009]

F16F15/131A . . . . [N: for damping of axial or radial, i.e. non-torsional vibrations]

F16F15/131C . . . . [N: characterised by modifications for auxiliary purposes, e.g. provision of a timing mark] [N0302]

F16F15/131F . . . . [N: characterised by clutch arrangements, e.g. for activation; integrated with clutch members, e.g. pressure member] [N0504]

F16F15/131L . . . . [N: the damping action being at least partially controlled by centrifugal masses (flywheels characterised by means to vary the moment of inertia F16F15/31)] [N9907] [C0106]

F16F15/131L2 . . . . . [N: simple connection or disconnection of members at speed] [N0504]

F16F15/131M . . . . [N: characterised by the method of assembly, production or treatment (F16F15/131C takes precedence)] [C0302]

F16F15/131M2 . . . . . [N: Multi-part primary or secondary masses, e.g. assembled from pieces of sheet steel] [N0209] [C0302]

F16F15/131P . . . . [N: with a kinematic mechanism or gear system, e.g. planetary (F16F15/131L takes precedence)] [N9907] [C0106]

F16F15/131S . . . . [N: characterised by the supporting arrangement of the damper unit]

F16F15/131S2 . . . . . [N: Bearing arrangements (F16F15/131S6 takes precedence)] [N9610] [C0209]

F16F15/131S2S . . . . . [N: comprising slide bearings] [N0108]

F16F15/131S4 . . . . . [N: Bolting arrangements (F16F15/131S2 takes precedence)] [N9908]

F16F15/131S6 . . . . . [N: Thermal shielding] [N0209]

F16F15/133 . . . . using springs as elastic members, e.g. metallic springs

F16F15/133C . . . . . [N: C-shaped springs] [N9705]

F16F15/133C1 . . . . . [N: disposed around axis of rotation] [N9705]

F16F15/133D . . . . . [N: Spiral springs, e.g. lying in one plane, around axis of rotation] [N9705]

F16F15/133F . . . . . [N: Folded springs, i.e. made of band-like material folded in an enclosing space] [N9705]

F16F15/133L . . . . . [N: Leaf springs, e.g. radially extending] [N9705]

F16F15/133T . . . . . [N: Torsional springs, e.g. torsion bar or torsionally-loaded coil springs] [N9705]

F16F15/133V . . . . . [N: Motion-limiting means, e.g. means for locking the spring unit in pre-defined positions (F16F15/131L takes precedence)] [N9705] [C0504]

F16F15/134 . . . . . Wound springs [N: (F16F15/133D, F16F15/133T, F16F15/137 take precedence)] [C0305]

F16F15/134B . . . . . [N: Radially mounted springs] [N9705]

F16F15/134D . . . . . [N: characterised by the dimension or shape of spring-containing windows] [N9705]

F16F15/134D3 . . . . . {7 dots} [N: Disposition of material for damping or avoiding wear] [N9705]

F16F15/134M . . . . . [N: characterised by the spring mounting (F16F15/134B, F16F15/134D take precedence)] [N9705]

F16F15/134M1 . . . . . {7 dots} [N: End-caps for springs] [N9705]

F16F15/134M1B . . . . . {8 dots} [N: having internal abutment means] [N9705]

F16F15/134M3 . . . . . {7 dots} [N: Additional guiding means for springs] [N9705]

F16F15/134M5 . . . . . {7 dots} [N: Set of springs, e.g. springs within springs] [N9705]

F16F15/134N . . . . . [N: Combinations of dampers, e.g. with multiple plates, multiple spring sets, i.e. complex configurations] [N9705]

F16F15/134N2 . . . . . {7 dots} [N: resulting in a staged spring characteristic, e.g. with multiple intermediate plates] [N9705] [C0001]

F16F15/134N2D . . . . . {8 dots} [N: acting on multiple sets of springs] [N9705]

F16F15/134N2D2 . . . . . {9 dots} [N: the sets of springs being arranged at substantially the same radius] [N9705]

F16F15/136 . . . . . Plastics springs, e.g. made of rubber (F16F15/134, [N: F16F15/137] take precedence) [C9604]

F16F15/137 . . . . . the elastic members consisting of two or more springs of different kinds, [N: e.g. elastomeric members and wound springs] [C9907]

F16F15/139 . . . . characterised by friction-damping means [N: (F16F15/131L takes precedence)] [C9907]

F16F15/139A . . . . . characterised by arrangements for axially clamping or positioning or otherwise influencing the frictional plates] [N0708]

F16F15/139B . . . . . [N: characterised by main friction means acting radially outside the circumferential lines of action of the elastic members] [N0108]

F16F15/139L . . . . . [N: Overload protection, i.e. means for limiting torque] [N9703]

F16F15/14 . . using masses freely rotating with the system, [N: i.e.uninvolved in transmitting driveline torque, e.g. rotative dynamic dampers (compensation of inertia forces F16F15/22; weights for balancing rotating bodies F16F15/32)] [C0504]

F16F15/14B . . . [N: the rotation being limited with respect to the driving means] [N9702]

F16F15/14B1 . . . . [N: Masses driven by elastic elements (F16F15/14B3, F16F15/14B5 take precedence)] [N9709] [C0305]

F16F15/14B1F . . . . . [N: Metallic springs, e.g. coil or spiral springs] [N9709]

F16F15/14B1F3 . . . . . [N: with a single mass] [N9709]

F16F15/14B1H . . . . . [N: Elastomeric springs, i.e. made of plastic or rubber] [N9709]

F16F15/14B1H3 . . . . . [N: with a single mass] [N9709]

F16F15/14B3 . . . . [N: Masses mounted with play with respect to driving means thus enabling free movement over a limited range] [N9709]

F16F15/14B3S . . . . . [N: Systems with a single mass] [N0209]

F16F15/14B5 . . . . [N: Masses connected to driveline by a kinematic mechanism or gear system (F16F15/14B3 takes precedence)] [N9709]

F16F15/14B5D . . . . . [N: with a kinematic mechanism, i.e. linkages, levers] [N9709]

F16F15/14B5F . . . . . [N: with a planetary gear system] [N9709]

F16F15/14N . . . [N: the rotation being unlimited with respect to driving means (with a fluid connection between inertia member and rotating driving means F16F15/167)] [N9702] [C0302]

F16F15/14N1 . . . . [N: with a dry-friction connection] [N9709]

F16F15/16 . . using a fluid [N: or pasty material] (F16F9/53, F16F15/131P take precedence; devices connecting input and output members F16D) [C0302]

F16F15/16C . . . [N: characterised by the fluid damping devices, e.g. passages, orifices (F16F15/16D takes precedence)]

F16F15/16D . . . [N: with forced fluid circulation]

F16F15/16L . . . [N: fluid acting as a lubricant] [N0001]

F16F15/16M . . . [N: characterised by manufacturing, e.g. assembling or testing procedures]

F16F15/16S . . . [N: Sealing arrangements] [N9610]

F16F15/167 . . . having an inertia member, e.g. ring

F16F15/173 . . . . provided within a closed housing [N: (F16F15/36 takes precedence)] [C9610]

F16F15/18 . . using electric, [N: magnetic or electromagnetic] means ([N: suppression of vibrations of rotating systems by use of non-rotating magnetic or electromagnetic means F16F15/03]; dynamo-electric devices H02K; [N: control effected upon generator excitation circuit to reduce harmful effects of overloads or transients H02P9/10]) [C0708]

F16F15/20 . Suppression of vibrations of rotating systems by favourable grouping or relative arrangements of the moving members of the system or systems [N: (F16F15/24 takes precedence)]

F16F15/22 . Compensation of inertia forces [N: (suppression of vibrations of rotating systems by favourable grouping or relative arrangements of the moving members of the system or systems F16F15/20, counterweights F16F15/28; correcting-weights for balancing rotating bodies F16F15/32)] [C0305]

F16F15/22B . . [N: Use of systems involving rotary unbalanced masses where the phase-angle of masses mounted on counter-rotating shafts can be varied (generation of mechanical vibrations per se with such systems B06B1/16B4)] [N0708]

F16F15/22S . . [N: in star engine arrangements] [N0504]

F16F15/24 . . of crankshaft systems by particular disposition of cranks, pistons, or the like [N: (shape of crankshafts or eccentric-shafts having regard to balancing F16C3/20)] [C0305]

F16F15/26 . . of crankshaft systems using solid masses, other than the ordinary pistons, moving with the system, [N: i.e. masses connected through a kinematic mechanism or gear system (F16F15/22S takes precedence)] [C0504]

F16F15/26L . . . [N: where masses move linearly]

F16F15/26P . . . [N: Masses attached to pinions, camshafts ordriving shafts for auxiliary equipment, e.g. for an oil pump] [N0708]

F16F15/26R . . . [N: Rotating balancer shafts (F16F15/26P takes precedence)] [C0504]

F16F15/26R2 . . . . [N: Arrangement of two or more balancer shafts (F61F15/26R4 takes precedence)] [N9908] [C0107]

F16F15/26R4 . . . . [N: characterised by bearing support of balancer shafts; Lubrication arrangements] [N0009] [C0107]

F16F15/26R6 . . . . [N: Hollow shafts] [N0504]

F16F15/28 . Counterweights, [N: i.e. additional weights counterbalancing inertia forces induced by the reciprocating movement of masses in the system, e.g. of pistons attached to an engine crankshaft (rotating balancer shafts F16F15/26R; correcting-weights for balancing rotating bodies F16F15/32)]; Attaching or mounting same [C0302]

F16F15/28C . . [N: for engine crankshafts] [N0302]

F16F15/28C2 . . . [N: Adjustable weights] [N0708]

F16F15/30 . Flywheels (F16F15/16, F16F15/28 take precedence; suppression of vibrations in rotating systems using elastic members or friction-damping members moving with the system, [N: i.e. split flywheels or single masses connected to a hub by elastic members or friction-damping members] F16F15/12; rotary-body aspects in general F16C13/00, F16C15/00) [C0305]

F16F15/30D . . [N: comprising arrangements for cooling or thermal insulation]

F16F15/305 . . made of plastics, e.g. fibre-reinforced plastics (FRP), [N: i.e. characterised by their special construction from such materials] [C0504]

F16F15/31 . . characterised by means for varying the moment of inertia

F16F15/315 . . characterised by their supporting arrangement, e.g. mountings, cages, securing inertia member to shaft (F16F15/31 takes precedence)

F16F15/315A . . . [N: Securing inertia members to the shafts]

F16F15/315B . . . [N: Arrangement of the bearings]

F16F15/32 . Correcting- or balancing-weights or equivalent means for balancing rotating bodies, e.g. vehicle wheels [N: (suppression of vibrations in rotating systems by using freely rotating masses F16F15/14; compensation of inertia forces F16F15/22; compensating unbalance for testing purposes G01M1/30)] [C0504]

F16F15/32S . . [N: the rotating body being a shaft (F16F15/34, F16F15/36 take precedence)]

F16F15/32W . . [N: the rotating body being a vehicle wheel (F16F15/36 takes precedence; tyre parts or constructions not otherwise provided for B60C19/00)] [C0001]

F16F15/32W2 . . . [N: specially adapted for attachment to spokes] [N0205]

F16F15/32W4 . . . [N: Multiple weights on adhesive strip] [N0209]

F16F15/34 . . Fastening arrangements therefor [C0504]

[N: Informative note
Hand held gripping tools B25B7/00]

F16F15/34W . . . [N: specially adapted for attachement to a vehicle wheel] [N0504]

F16F15/36 . . operating automatically, [N: i.e. where, for a given amount of unbalance, there is movement of masses until balance is achieved (damping vibrations of washing machines by displacing, supplying or ejecting a material, e.g. liquid, into or from counterbalancing pockets D06F37/24B)] [C0107]

F16F15/36B . . . [N: using rolling bodies, e.g. balls free to move in a circumferential direction] [N9610] [C0504]

F16F15/36F . . . [N: using fluid or powder means, i.e. non-discrete material]