COOPERATIVE PATENT CLASSIFICATION

MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

ENGINEERING IN GENERAL

ENGINEERING ELEMENTS AND UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL

SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION

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.

   A47C 23/00 - A47C 27/00 Spring mattresses
   A61F 2/00 [Prostheses]
   A63C 5/075 Vibration dampers in skis
   B60G Vehicle suspensions
   B60R 19/24 Mounting of bumpers on vehicles
   B61F Rail vehicle suspensions
   B61G 11/00 Buffers for railway or tramway vehicles
   B62D 21/15 Vehicle chassis frames having impact absorbing means
   B62J 1/02 Resiliently mounted saddles on cycles
   B62K 21/08 Steering dampers
   B63H 21/30 Anti-vibration mounting of marine propulsion plant in ships
   B64C 25/58 Arrangement of shock-absorbers or springs in aeroplane alighting gear
   B65D 81/02 Containers, packing elements or packages with shock-absorbing means
   D06F 37/20 Resilient mountings in washing machines
   D06F 49/06 Resilient mountings in domestic spin-dryers
   {E04B 1/98} [Protection of buildings against vibrations or shocks]
   E05D 7/086 Braking devices structurally combined with hinges
   F03G 1/00 Spring motors
   {F16L 3/20} [Pipe or cable supports]
   F21V 15/04 Resilient mounting of lighting devices
   F41A 25/00 Gun cradles to permit recoil
   F41B 3/142 Vibration dampers for archery bows
   G01D 11/00 Indicating or recording in connection with measuring
   G01G 21/10 Weighing apparatus, e.g. arrangement of shock-absorbers in weighing apparatus
   G04B Clocks, watches
   G12B 3/08 Damping of movements in instruments
   G21C 7/20 Disposition of shock-absorbing devices for displaceable control elements in nuclear reactors.
   {H02G 7/14} [Arrangements or devices for damping mechanical oscillations of power lines]

3. 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 F16F 1/00, i.e. material having low internal friction. This normally includes composite materials such as fibre-reinforced plastics.

4. 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 F16F 1/36, 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 F16F 1/366 - F16F 1/3686 and F16F 15/305.

WARNINGS
1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

   F16F 3/07 covered by F16F 13/00
   F16F 9/24 covered by F16F 9/22
   F16F 9/40 covered by F16F 9/00 - F16F 9/50
   F16F 9/508 covered by F16F 9/512
   F16F 11/00 covered by F16F 7/00, F16F 9/00, F16F 15/00
   F16F 13/12 covered by F16F 13/08
2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

**I/00**

Springs (working with fluid F16F 5/00, F16F 9/00)

1/02 . . . made of steel or other material having low internal friction (characterised by their special construction from fibre-reinforced plastics F16F 1/366; spring units consisting of several springs F16F 3/02; making springs from wire B21F 35/00); Wound, torsion, leaf, cup, ring or the like springs, the material of the spring not being relevant

1/021 . . . (characterised by their composition, e.g. comprising materials providing for particular spring properties (composition and manufacture of clock or watch springs G04B 1/145)

1/022 . . . {made of ceramic materials}

1/024 . . . {Covers or coatings therefor (F16F 1/24 takes precedence)}

1/025 . . . {characterised by having a particular shape (F16F 1/04, F16F 1/14, F16F 1/18, F16F 1/32, F16F 1/34 take precedence)}

1/027 . . . [Planar, e.g. in sheet form; leaf springs]

1/028 . . . [cylindrical, with radial openings]

1/04 . . . Wound springs {making springs by coiling wire B21F 3/00}

1/041 . . . {with means for modifying the spring characteristics (F16F 1/12, F16F 3/06 take precedence; fluid regulation of coil spring characteristics in vehicle suspensions B60G 17/0272)}

1/042 . . . [characterised by the cross-section of the wire]

1/043 . . . [the cross-section varying with the wire length]

1/045 . . . [Canted-coil springs]

1/046 . . . [with partial nesting of inner and outer coils (F16F 3/04 takes precedence)]

1/047 . . . [characterised by varying pitch]

1/048 . . . [with undulations, e.g. wavy springs]

1/06 . . . with turns lying in cylindrical surfaces

1/065 . . . {characterised by loading of the coils in a radial direction (canted-coil springs F16F 1/045)}

1/08 . . . with turns lying in mainly conical surfaces [. i.e. characterised by varying diameter (F16F 1/10 takes precedence)]

1/10 . . . Spiral springs with turns lying substantially in plane surfaces [(F16F 1/326 takes precedence)]

1/12 . . . Attachments or mountings [(F16F 1/041, F16F 13/02 take precedence; of combinations of vibration damper and mechanical spring for vehicle suspension units B60G 15/02)]

1/121 . . . [Adjustable, e.g. to modify spring characteristics]

1/122 . . . [where coils, e.g. end coils, of the spring are rigidly clamped or similarly fixed]

1/123 . . . [characterised by the ends of the spring being specially adapted, e.g. to form an eye for engagement with a radial insert (F16F 1/122, F16F 1/125 take precedence)]

1/125 . . . [where the end coils of the spring engage an axial insert (F16F 1/126, F16F 1/128 take precedence)]

1/126 . . . . . . (comprising an element between the end coil of the spring and the support proper, e.g. an elastomeric annulus (F16F 1/13 takes precedence))

1/127 . . . . . . [allowing rotation about axis of spring]

1/128 . . . . . . [with motion-limiting means, e.g. with a full-length guide element or ball joint connections; with protective outer cover (F16F 1/121 takes precedence)]

1/13 . . . . . . [comprising inserts and spacers between the windings for changing the mechanical or physical characteristics of the spring (F16F 1/122 takes precedence)]

1/14 . . . . . . Torsion springs consisting of bars or tubes

1/145 . . . . . . [with means for modifying the spring characteristics (fluid regulation of torsion spring characteristics in vehicle suspensions B60G 17/0272)]

1/16 . . . . . . Attachments or mountings [(F16F 1/145 takes precedence; mounting means for vehicle stabiliser bars B60G 21/0551)]

1/18 . . . . . . Leaf springs {planar springs in general F16F 1/027; "Belleville"-type springs with generally radial arms F16F 1/324)]

1/182 . . . . . . [with inter-engaging portions between leaves or between leaves and mountings, e.g. ridges, notches, nipples]

1/185 . . . . . . [characterised by shape or design of individual leaves (F16F 1/22 takes precedence)]

1/187 . . . . . . [shaped into an open profile, i.e. C- or U-shaped]

1/20 . . . . . . with layers, e.g. anti-friction layers, or with rollers between the leaves

1/22 . . . . . . [with means for modifying the spring characteristic (fluid regulation of leaf spring characteristics in vehicle suspensions B60G 17/0275)]

1/23 . . . . . . [with means for modifying the spring characteristics (fluid regulation of leaf spring characteristics in vehicle suspensions B60G 17/0275)]

1/24 . . . . . . Lubrication; Covers, e.g. for retaining lubricant

1/26 . . . . . . Attachments or mountings ((F16F 1/182, F16F 1/22) B60G 11/10 take precedence)

1/28 . . . . . . [comprising cylindrical metal pins pivoted in close-fitting sleeves

1/30 . . . . . . [comprising intermediate pieces made of rubber or similar elastic material

1/32 . . . . . . Belleville-type springs (friction-clutch diaphragm springs F16D 13/583)

1/322 . . . . . . (Snap-action springs)

1/324 . . . . . . [characterised by having tongues or arms directed in a generally radial direction, i.e. diaphragm-type springs]

1/326 . . . . . . [with a spiral-like appearance]

1/328 . . . . . . [with undulations, e.g. wavy springs]

1/34 . . . . . . Ring springs, i.e. annular bodies deformed radially due to axial load

1/36 . . . . . . [made of rubber or other material having high internal friction, e.g. thermoplastic elastomers (spring units consisting of several springs F16F 3/08)]
characterised by arrangements for controlling the spring temperature, e.g. by cooling

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 F16F 1/366 - F16F 1/386.

1/365 . . . [Wound springs]
1/368 . . . Leaf springs
1/3683 . . . [Attachments or mountings therefor]
1/3686 . . . [End mountings]
1/37 . . . of foam-like material (i.e. microcellular material), e.g. sponge rubber (e.g. padded linings for vehicle interiors B60R 21/04)
1/371 . . . characterised by inserts or auxiliary extension (or exterior) elements, e.g. for rigidification (F16F 1/387 takes precedence; (non-embedded reinforcing elements for flexibly-walled air springs F16F 9/0436))
1/3713 . . . [with external elements passively influencing spring stiffness, e.g. rings or hoops]
1/3716 . . . [External elements such as covers or envelopes, that are flexible]
1/373 . . . characterised by having a particular shape (F16F 9/58 takes precedence)
1/3732 . . . [having an annular or the like shape, e.g. grommet-type resilient mountings]
1/3735 . . . [Multi-part grommet-type resilient mountings]
1/3737 . . . [Planar, e.g. in sheet form (vibration dampers comprising one or more constrained viscoelastic layers F16F 9/306)]
1/374 . . . having a spherical or the like shape
1/376 . . . having projections, studs, serrations or the like on at least one surface (F16F 1/3835, F16F 1/387 take precedence)
1/377 . . . having holes or openings (F16F 1/37, F16F 1/387 take precedence)
1/379 . . . characterised by adaptations for particular modes of stressing

NOTE
Classification of documents in groups F16F 1/42 - F16F 1/54, concerning the mode of stressing of elastomeric springs, is to be considered only when classification in other subgroups of F16F 1/36 would be unsuitable. Attention is drawn to the parallel scheme of indexing codes under F16F 2236/00.
NOTE

In this group, vehicle leaf spring units, i.e. "packets" of individual leaves, are considered as a single spring.

3/02... with springs made of steel or of other material having low internal friction
3/023... [composed only of leaf springs]
3/026... [to give a zero-spring rate characteristic]
3/04... composed only of wound springs
3/06... of which some are placed around others in such a way that they damp each other by mutual friction
3/08... with springs made of a material having high internal friction, e.g. rubber ([multi-part grommet-type resilient mountings F16F 1/3735])
3/087... Units comprising several springs made of plastics or the like material ([F16F 1/40, F16F 1/545] take precedence)
3/0873... [of the same material or the material not being specified]
3/0876... [and of the same shape]
3/093... the springs being of different materials, e.g. having different types of rubber ([F16F 1/3835 takes precedence])
3/0935... [and being of the same shape]
3/10... combined with springs made of steel or other material having low internal friction
3/12... the steel spring being in contact with the rubber spring ([F16F 1/12 takes precedence])
5/00 Liquid springs in which the liquid works as a spring by compression, e.g. combined with throttling action; Combinations of devices including liquid springs ([dampers with solid or semi-solid material F16F 9/30])
6/00 Magnetic springs ([magnetic spring arrangements for the suppression of vibration in systems F16F 15/03]); Fluid magnetic springs ([i.e. magnetic spring combined with a fluid])

7/00 Vibration-dampers; Shock-absorbers (using fluid F16F 5/00, F16F 9/00; specific for rotary systems F16F 15/10; belt tensioners F16H 7/121)
7/003... [One-shot shock absorbers (using plastic deformation of members, e.g. using sacrificial, fibre-reinforced composite members F16F 7/121)]
7/006... [using textile means (safety belts or body harnesses incorporating energy absorbing means A62B 35/04)]
7/01... using friction between loose particles, e.g. sand
7/015... [the particles being spherical, cylindrical or the like]
7/02... with relatively-rotatable friction surfaces that are pressed together ([F16F 7/01 takes precedence]; one of the members being a spring F16F 13/02; friction devices between relatively-movable parts of a hinge E05D 11/08; braking devices for wings E05F 5/00])
7/023... [and characterised by damping force adjustment means]
7/026... [resulting in the damping effects being different according to direction of rotation]
7/04... in the direction of the axis of rotation ([F16F 7/023 takes precedence])
7/06... in a direction perpendicular or inclined to the axis of rotation ([F16F 7/023 takes precedence])
7/065... [where elements interengaging frictionally are in the shape of spiral bands]
7/08... with friction surfaces rectilinearly movable along each other ([F16F 7/01 takes precedence]; one of the members being a spring F16F 13/02)]
7/082... [and characterised by damping force adjustment means]
7/085... [resulting in the damping effects being different according to direction of movement]
7/087... [Elastomeric surface effect dampers]
7/09... in dampers of the cylinder-and-piston type
7/095... [frictional elements brought into engagement by movement along a surface oblique to the axis of the cylinder, e.g. interaction of wedge-shaped elements]
7/10... using inertia effect ([F16F 13/108, F16F 13/22, F16F 15/10, F16F 15/22 take precedence]; stabilising vehicle bodies by means of movable masses B62D 37/04; protection of buildings against vibrations or shocks by mass dampers E04B 1/985; arrangements or devices for damping mechanical oscillations of power lines H02G 7/14]
7/1005... [characterised by active control of the mass]
7/1011... [by electromagnetic means]
7/1017... [by fluid means]
7/1022... [the linear oscillation movement being converted into a rotational movement of the inertia member, e.g. using a pivoted mass]
7/1028... [the inertia-producing means being a constituent part of the system which is to be damped]
7/1034... [of movement of a liquid]
7/104... the inertia member being resiliently mounted ([F16F 7/1022 takes precedence])
7/108... on plastics springs
7/112... on fluid springs
7/116... on metal springs
9/00 Springs, vibration-dampers, shock-absorbers, or similarly-constructed movement-dampers using a fluid or the equivalent as damping medium (F16F 5/00 takes precedence; connection of valves to inflatable elastic bodies B60C 29/00; braking devices, stops or buffers for wing-operating valves to inflatable elastic bodies B60C 29/00; means for adjusting the length of, or for locking, the spring or dampers)  
9/003 . [Dampers characterised by having pressure absorbing means other than gas, e.g. sponge rubber]  
9/006 . [characterised by the nature of the damping medium, e.g. biodegradable (variable viscosity damping adjustment F16F 9/53)]  
9/02 . using gas only (or vacuum (F16F 9/006 takes precedence))  
9/0209 . [Telescopic (F16F 9/04 takes precedence)]  
9/0218 . [Mono-tubular units (F16F 9/0227, F16F 9/0236, F16F 9/0245 takes precedence)]  
9/0227 . [characterised by the piston construction]  
9/0236 . [characterised by having a hollow piston rod]  
9/0245 . [Means for adjusting the length of, or for locking, the spring or dampers]  
9/0254 . . . . [mechanically lockable, e.g. by use of friction collar (mechanical locking of extensible devices for holding wings E05C 17/30)]  
9/0263 . . . . [characterised by actuation means, e.g. manually-operated lever arrangement (F16F 9/0254 takes precedence)]  
9/0272 . . . . [with control rod extending through the piston rod into the piston]  
9/0281 . . . . [Details]  
9/029 . . . . [electrical, e.g. connections or contacts]  
9/04 . . . . in a chamber with a flexible wall (producing hollow articles of plastics, e.g. air bellows, B29D 22/00)
using liquid only; using a fluid of which the nature is immaterial

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 (F16F 9/53 takes precedence)

Devices with one or more rotary vanes turning in the fluid any throttling effect being immaterial, i.e. damping by viscous shear effect only (F16F 9/53 takes precedence; pivoting supports for apparatus or articles placed on stands or trestles F16M 11/06)

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

Involving only rotary movement of the effective parts (wing closers or openers with fluid brakes of the rotary type E05F 3/14)

Involving only straight-line movement of the effective parts (wing closers or openers with liquid piston brakes E05F 3/04)

With two or more cylinders in line, i.e. in series connection (F16F 9/26 takes precedence)

With a closed cylinder and a piston separating two or more working spaces therein

Comprising a hollow piston rod

Bitubular units (where compression of gas leads to a clear spring action F16F 9/062)

With uni-directional flow of damping fluid through the valves

With a single cylinder (and of single-tube type)

With the piston-rod extending through both ends of the cylinder, e.g. constant-volume dampers

With one or more cylinders each having a single working space closed by a piston or plunger

With two cylinders in line and with the two pistons or plungers connected together

With two parallel cylinders and with the two pistons or plungers connected together

By a rocker arm

With solid or semi-solid material, e.g. pasty masses, as damping medium (in devices where rotary elements are damped by viscous shear effect only, any throttling effect being immaterial F16F 9/12; where members moving with a rotating system are being damped F16F 15/16)

The damper being of the telescopic type

Of the constrained layer type, i.e. comprising one or more constrained viscoelastic layers

Details

(Constructional features (F16F 9/34 - F16F 9/50 take precedence; assembly or repair F16F 9/3271))

Of pistons (F16F 9/0227 and F16F 9/36 take precedence; throttling passages in or on piston body F16F 9/3405)

Of piston rods

Of connections between pistons and piston rods

Of cylinders (F16F 9/483 takes precedence)

Of cylinder ends, e.g. caps

For attachment of valve units

In twin-tube type devices

Arrangements for indicating, e.g. fluid level; Arrangements for checking dampers (F16F 9/3292 takes precedence; testing of vehicle damping G01M 17/04)

Assembly or repair

For lubrication (lubricating per se F16N)

For filtering (filters per se B01D)

Sensor arrangements

Special valve constructions (F16F 9/44, F16F 9/50 take precedence; filtering details F16F 9/3285) ; valves in general F16K ; Shape or construction of throttling passages

Throttling passages in or on piston body, e.g. slots (F16F 9/344, F16F 9/3481 take precedence)

Comprising noise-reducing or like features, e.g. screens (F16F 9/3415 takes precedence)

Characterised by comprising plastics, elastomeric or porous elements

Throttling passages operating with metering pins (F16F 9/486 takes precedence)

Vortex flow passages

Throttling passages in the form of slots arranged in cylinder walls

Slots having a variable section along their length

Throttling passages in the form of annular discs [or other plate-like elements which may or may not have a spring action], operating in opposite directions [or singly, e.g. annular discs positioned on top of the valve or piston body (F16F 9/341, F16F 9/3415 take precedence)

Characterised by shape or construction of throttling passages in piston (F16F 9/344 takes precedence)

The annular discs being incorporated within the valve or piston body (F16F 9/3484, F16F 9/3485 take precedence)

Characterised by features of the annular discs per se, singularly or in combination

Characterised by features of supporting elements intended to guide or limit the movement of the annular discs (F16F 9/3488 takes precedence)

With spacers or spacing rings

Characterised by features intended to affect valve bias or pre-stress
Special sealings, including sealings or guides for piston-rods (F16F 9/325, F16F 9/3485) take precedence; arrangements for filling via piston rod sealing or guiding means (F16F 9/342); sealing of moving parts in general (F16J 15/16, F16J 15/56).

[Sealings of the bellows-type]

Combination of sealing and guide arrangements for piston rods (F16F 9/361, F16F 9/365) take precedence.

-the guide being mounted between the piston and the sealing, enabling lubrication of the guide.

[of multi-tube dampers]

-the sealing arrangement having a pressurised chamber separated from the damping medium.

[functioning as guide only, e.g. bushings]

-[allowing misalignment of the piston rod]

[Sealings in pistons]

-[Sealings for elements other than pistons or piston rods, e.g. valves]

-Covers for protection or appearance

Cooling arrangements

-Filling (or drainage) arrangements, e.g. for supply of gas (filling vessels with, or discharging from vessels, compressed, liquefied, or solidified gases F17G).

-via piston rod sealing or guiding means)

-via opening in cylinder wall (F16F 9/432) takes precedence)

-Drainage arrangements)

-Means on or in the damper for manual or non-automatic adjustment; such means combined with temperature correction (F16F 9/53, F16F 13/26) take precedence; temperature correction only (F16F 9/52).

-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.

-Adjustment of valve bias or pre-stress (F16F 9/443) takes precedence)

-allowing control from a distance, 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 F16F 9/325)

-characterised by actuation means)

-rotary actuation means)

-characterised by electrical connections]

-Control of valve bias or pre-stress, e.g. electromagnetically (F16F 9/465) takes precedence)

-[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 F16F 9/50)]

-Throttling control, i.e. regulation of flow passage geometry (F16F 9/464, F16F 9/465) takes precedence)

(using rotary valves)

-controlling at least one bypass to main flow path]

-[Valves incorporated in the piston (F16F 9/467) takes precedence)]

-Arrangements for providing different damping effects at different parts of the stroke (F16F 9/346, F16F 9/516, F16F 9/53) take precedence)

-characterised by giving a particular shape to the cylinder, e.g. conical)

-[comprising a pin or stem co-operating with an aperture, e.g. a cylinder-mounted stem co-operating with a hollow piston rod]

-Stops limiting fluid passage, e.g. hydraulic stops [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 F15B 15/22)]

-Special means providing automatic damping adjustment, i.e. self-adjustment of damping by particular sliding movements of a valve element, other than flexions or displacement of valve discs (F16F 9/53) takes precedence; Special means providing self-adjustment of spring characteristics)

-Inertia, i.e. acceleration-sensitive means

-Means responsive to load action, i.e. static load on the damper or dynamic fluid pressure changes in the damper, e.g. due to changes in velocity (F16F 9/504, F16F 9/516) take precedence; non-automatic damper adjustment from a distance using servo control, the servo pressure being created by the flow of damping fluid F16F 9/465; self-pumping fluid springs in vehicle suspensions B60G 17/044)

-responsive to the static or steady-state load on the damper)

-[Piston, or piston-like valve elements (F16F 9/504) takes precedence)]

-resulting in the damping effects during contraction being different from the damping effects during extension, i.e. responsive to the direction of movement (F16F 9/504) takes precedence)

-[by use of spherical valve elements or like free-moving bodies]

-in case of change of temperature (F16F 9/003) takes precedence; combined with external adjustment F16F 9/44)

-[with coil or spiral of bimetallic elements being used to change flow cross-section]

-[Self-adjustment of fluid springs]

-Means for adjusting damping characteristics by varying fluid viscosity, e.g. electromagnetically (F16F 13/30) takes precedence; brakes comprising a medium with electrically or magnetically controlled friction F16D 57/002; electrorheological fluids per se C10M 171/001; magnetorheological fluids per se H01F 1/447)]

-[Electrorheological [ER] fluid dampers]

-[Magnetorheological [MR] fluid dampers (springs comprising magnetorheological [MR] elastomers F16F 1/361)]

-[specially adapted valves therefor]
Units comprising springs of the non-fluid type as well as vibration-dampers, shock-absorbers, or fluid springs (F16F 5/00, F16F 6/00, F16F 9/003) take precedence

13/02 . . . [comprising at least one fluid spring (F16F 13/005, F16F 13/012, F16F 13/04 take precedence)]

13/05 . . . [comprising both a wound spring and a damper, e.g. a friction damper]

13/07 . . . . . (the damper being a fluid damper)

13/02 . . . damping by frictional contact between the spring and braking means (frictionally coacting wound springs F16F 3/06)

13/04 . . . comprising both a plastics spring and a damper, e.g. a friction damper

13/06 . . . . 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 (F16F 13/26 takes precedence)

13/08 . . . . . . the plastics spring forming at least a part of the wall of the fluid chamber of the damper (F16F 13/20 - F16F 13/24 take precedence)

13/085 . . . . . . [characterised by features of plastics springs; Attachment arrangements]

13/10 . . . . . . the wall being at least in part formed by a flexible membrane or the like (F16F 13/14 - F16F 13/18 take precedence)

13/101 . . . . . . [characterised by buffering features or stoppers]

13/102 . . . . . . [characterised by features of flexible walls of equilibration chambers; decoupling or self-tuning means]

13/103 . . . . . . [characterised by method of assembly, production or treatment]

13/105 . . . . . . [characterised by features of partitions between two working chambers]

13/106 . . . . . . [Design of constituent elastomeric parts, e.g. decoupling valve elements, or of immediate abutments therefor, e.g. cages]

13/107 . . . . . . [Passage design between working chambers]

13/108 . . . . . . (characterised by features of plastics springs, e.g. attachment arrangements (F16F 13/18 takes precedence))

13/14 . . . . . . . Units of the bushing type {, i.e. loaded predominantly radially (bushes F16F 1/38; mounting brackets therefor F16F 1/3849)}

13/1409 . . . . . . . [characterised by buffering features or stoppers]
15/00 Suppression of vibrations in systems (damping of non-rotary systems using inertia effect F16F 7/10; prevention or isolation of vibrations in machine tools B23Q 11/0032; suppression of driveline vibrations in hybrid vehicle transmissions B60W 30/20; vehicle seat suspension devices B60N 2/50; methods or devices for protecting against, or damping of, acoustic waves, e.g. sound G10K 11/16); Means or arrangements for avoiding or reducing out-of-balance forces, e.g., due to motion (vibration absorbing or balancing means for aircraft propellers B64C 11/008; for rotorcraft rotors B64C 27/001; testing static and dynamic balance of machines or structures G01M 1/00)

15/002 . . . (characterised by the control method or circuitry (control of mechanical oscillations per se G05D 19/00))

15/005 . . . (using electro- or magnetostriictive actuation means (generating of mechanical vibrations operating with electrostriction B00B 1/06; with magnetostriiction B00B 1/08; vehicle suspension arrangements characterised by use of piezo-electric elements B60G 17/01941; piezo-electric, electrostrictive and magnetostriictive devices per se H01L 41/00))

15/007 . . . (Piezo-electric elements being placed under pre-constraint, e.g. placed under compression)

15/02 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 (F16F 15/005 takes precedence); layered products B32B; suppression of vibration in ships B63; relieving load on bearings, using magnetic means F16C 39/06))

15/021 . . . (Decoupling of vibrations by means of point-of-contact supports, e.g. ball bearings)

15/022 . . . (using dampers and springs in combination)

15/023 . . . (using fluid means)

15/0232 . . . (with at least one gas spring (F16F 15/027 takes precedence))

15/0235 . . . (where a rotating member is in contact with fluid (rotary viscous dampers per se F16F 9/12; suppression of vibrations in rotating systems containing a fluid F16F 15/16))

15/0237 . . . (involving squeeze-film damping)

15/027 . . . (comprising control arrangements (F16F 15/0237 takes precedence))

15/0275 . . . (Control of stiffness)

15/03 . . . (using [magnetic or] electromagnetic means (F16F 9/53, F16F 15/005) take precedence)

15/035 . . . (by use of eddy or induced-current damping (dynamo-electric brakes of the eddy-current type H02K 49/04))

15/04 . . . (using elastic means (single elements or their attachment F16F 1/00 - F16F 15/300); (F16F 15/023, F16F 15/03) take precedence)

15/043 . . . (acting on a cam follower)

15/046 . . . (using combinations of springs of different kinds (F16F 15/085 takes precedence))

15/06 . . . (with metal springs (with rubber springs also F16F 15/08))

15/063 . . . (with bars or tubes used as torsional elements)

15/067 . . . (using only wound springs)

15/073 . . . (using only leaf springs)

15/08 . . . (with rubber springs ((grommet- or bushing-type resilient mountings F16F 1/3732, F16F 1/38); with springs made of rubber and metal (arrangement of internal-combustion or jet-propulsion units B60K 5/12; mounting of propulsion plants on vessels B63H 21/30; mounting of vehicle drivers' cabs B62D 33/064))

15/085 . . . ([Use of both rubber and metal springs])

15/10 Suppression of vibrations in rotating systems by making use of members moving with the system (by balancing F16F 15/22; yielding couplings F16D 3/001; with flywheels acting variably or intermittently F16H; construction providing resilience or vibration-damping for gear elements F16H 55/14))

15/12 . . . (using elastic members or friction-damping members, e.g. between a rotating shaft and a gyroratory mass mounted thereon ((F16F 15/14), F16F 15/16 take precedence)

15/1201 . . . ([for damping of axial or radial, i.e. non-torsional vibrations (F16F 15/13107 takes precedence])

15/1202 . . . ([the damping action being at least partially controlled by centrifugal masses (F16F 15/13128 takes precedence)])

15/1203 . . . ([characterised by manufacturing, e.g. assembling or testing procedures for the damper units (F16F 15/13142 takes precedence)])

15/1204 . . . ([with a kinematic mechanism or gear system (F16F 15/1202, F16F 15/13157 take precedence)])

15/1205 . . . ([with a kinematic mechanism, i.e. linkages, levers])

15/1206 . . . ([with a planetary gear system])

15/1207 . . . ([characterised by the supporting arrangement of the damper unit (F16F 15/1238, F16F 15/13164 take precedence)])

15/1208 . . . ([Bearing arrangements])

15/1209 . . . ([comprising sliding bearings])

15/121 . . . ([using springs as elastic members, e.g. metallic springs (F16F 15/133 takes precedence)])

15/1211 . . . ([C-shaped springs])

15/1212 . . . ([disposed around axis of rotation])

15/1213 . . . ([Spiral springs, e.g., lying in one plane, around axis of rotation])

15/1214 . . . ([Folded springs, i.e. made of band-like material folded in an enclosing space])

15/1215 . . . ([Leaf springs, e.g. radially extending])

15/1216 . . . ([Torsional springs, e.g., torsion bar or torsionally-loaded coil springs])

15/1217 . . . ([Motion-limiting means, e.g. means for locking the spring unit in pre-defined positions (F16F 15/1202, F16F 15/1338 take precedence)])

15/1218 . . . ([by means of spring-loaded radially arranged locking means])

15/1219 . . . ([by means of spring-loaded axially arranged locking means])

15/123 . . . (Wound springs (F16F 15/1213, F16F 15/1216, F16F 15/127 take precedence))

15/12306 . . . ([Radially mounted springs])
gyratory masses

the rotating system comprising two or more members, e.g. pressure member
taken precedence)

({ F16F 15/1202, F16F 15/1238
characterised by friction-damping means

Elastomeric springs (F16F 15/123, F16F 15/127 take precedence)

{ Elastic elements arranged between substantially-radial walls of two parts rotateable with respect to each other, e.g.

between engaging teeth

{ Combinations of dampers, e.g. with multiple plates, multiple spring sets; i.e.
complex configurations

{ Resulting in a staged spring characteristic, e.g. with multiple intermediate plates

{ Acting on multiple sets of springs

{ The sets of springs being arranged at substantially the same radius

{ With pre-damper, i.e. additional set of springs between flange of main damper and hub

{ Pre-damper cage construction

{ Pre-damper springs are of non-wound type, e.g. leaf springs

{ Elastomeric springs (F16F 15/123, F16F 15/127 take precedence)

{ Elastic elements arranged between substantially-radial walls of two parts rotateable with respect to each other, e.g.

between engaging teeth

{ Consisting of at least one annular element surrounding the axis of rotation

{ Using plastics springs combined with other types of springs

{ Characterised by friction-damping means

{ Characterised by arrangements for axially clamping or positioning or otherwise influencing the frictional plates

{ Characterised by means for interconnecting driven plates and retainer, cover plates

{ Overload protection, i.e. means for limiting torque

{ The rotating system comprising two or more gyrostatic masses

{ For damping of axial or radial, i.e. nontorsional vibrations

{ Characterised by modifications for auxiliary purposes, e.g. provision of a timing mark

{ Characterised by clutch arrangements, e.g. for activation; integrated with clutch members, e.g. pressure member

{ The damping action being at least partially controlled by centrifugal masses (flywheels characterised by means to vary the moment of inertia F16F 15/31)

{ Simple connection or disconnection of members at speed

{ Characterised by the method of assembly, production or treatment (F16F 15/13114 takes precedence)

{ Multi-part primary or secondary masses, e.g. assembled from pieces of sheet steel

{ With a kinematic mechanism or gear system, e.g. planetary (F16F 15/13128 takes precedence)

{ Characterised by the supporting arrangement of the damper unit

{ Bearing arrangements (F16F 15/13192 takes precedence)

{ Comprising slide bearings

{ Bolting arrangements (F16F 15/13171 takes precedence)

{ Thermal shielding

{ Using springs as elastic members, e.g. metallic springs

{ C-shaped springs

{ Disposed around axis of rotation

{ Spiral springs, e.g. lying in one plane, around axis of rotation

{ Folded springs, i.e. made of band-like material folded in an enclosing space

{ Leaf springs, e.g. radially extending

{ Torsional springs, e.g. torsion bar or torsionally-loaded coil springs

{ Motion-limiting means, e.g. means for locking the spring unit in pre-defined positions (F16F 15/13128 takes precedence)

{ Radially mounted springs

{ Characterised by the dimension or shape of spring-containing windows

{ Disposition of material for damping or avoiding wear

{ Characterised by the spring mounting (F16F 15/13407, F16F 15/13415 take precedence)

{ End-caps for springs

{ Having internal abutment means

{ Additional guiding means for springs

{ Set of springs, e.g. springs within springs

{ Combinations of dampers, e.g. with multiple plates, multiple spring sets, i.e.
complex configurations

{ Resulting in a staged spring characteristic, e.g. with multiple intermediate plates

{ Acting on multiple sets of springs

{ The sets of springs being arranged at substantially the same radius

{ Plastics springs, e.g. made of rubber (F16F 15/134, F16F 15/137 take precedence)

{ The elastic members consisting of two or more springs of different kinds, e.g.
elastomeric members and wound springs
effects of overloads or transients \( H_02P \) 9/10
generator excitation circuit to reduce harmful electromagnetic means \( F_{16F} \) 15/03
systems by use of non-rotating magnetic or \{ control effected upon using electric, \{ magnetic or electromagnetic \}
connecting input and output members \( F_{16D} \) ( ), \( F_{16F} \) 9/53 inertia forces \( F_{16F} \) 15/22 e.g. rotative dynamic dampers ( compensation of inertia forces \( F_{16F} \) 15/22; weights for balancing rotating bodies \( F_{16F} \) 15/32) \{ characterised by manufacturing, e.g. with forced fluid circulation \} \( F_{16D} \) \{ characterised by axial fluid circulation \} \{ fluid acting as a lubricant \} \{ characterised by manufacturing, e.g. assembling or testing procedures \} \{ Sealing arrangements \} \{ having an inertia member, e.g. ring \} \{ provided within a closed housing \} \( F_{16E} \) 36/13 takes precedence \} \{ using electric, \{ magnetic or electromagnetic \} means \} \{ suppression of vibrations of rotating systems by use of non-rotating magnetic or electromagnetic means \( F_{16F} \) 15/03; \} dynamo-electric devices \( H_{02K} \); \{ control effected upon generator excitation circuit to reduce harmful effects of overloads or transients \( H_{02P} \) 9/10\}
15/32 . Correcting- or balancing-weights or equivalent means for balancing rotating bodies, e.g. vehicle wheels (suppression of vibrations in rotating systems by using freely rotating masses F16F 15/14; compensation of inertia forces F16F 15/22; compensating unbalance for testing purposes G01M 1/30)

15/322 . . . (the rotating body being a shaft (F16F 15/34, F16F 15/36 take precedence))

15/324 . . . (the rotating body being a vehicle wheel (F16F 15/36 takes precedence; tyre parts or constructions not otherwise provided for B60C 19/00))

15/326 . . . [specially adapted for attachment to spokes]

15/328 . . . [Multiple weights on adhesive strip]

15/34 . . . Fastenings arrangements therefor

NOTE
Hand held gripping tools B25B 7/00

15/345 . . . [specially adapted for attachment to a vehicle wheel]

15/36 . . . operating automatically, 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 D06F 37/245)

15/363 . . . [using rolling bodies, e.g. balls free to move in a circumferential direction]

15/366 . . . [using fluid or powder means, i.e. non-discrete material]

2222/00 Special physical effects, e.g. nature of damping effects

2222/02 . temperature-related (F16F 2228/002 takes precedence)

2222/025 . . . Cooling

2222/04 . Friction

2222/06 . Magnetic or electromagnetic

2222/08 . Inertia

2222/10 . Adhesion

2222/12 . Fluid damping

22/22/13 . decreasing with increasing flow

2222/126 . . . using gases

2222/14 . superconducting

2224/00 Materials; Material properties

2224/005 . Combined materials of same basic nature but differing characteristics

2224/02 . solids

2224/0208 . . . Alloys

2224/0216 . . . bimetallic

2224/0225 . . . Cellular, e.g. microcellular foam

2224/0233 . . . deforming plasticly in operation

2224/0241 . . . Fibre-reinforced plastics [FRP]

2224/0245 . . . Elastomers

2224/0258 . . . Shape-memory metals, e.g. Ni-Ti alloys

2224/0266 . . . porosity

2224/0275 . . . Ceramics

2224/0283 . . . piezoelectric; electro- or magnetostrictive

2224/0291 . . . PTFE

2224/04 . . . Fluids

2224/041 . . . Dilatant

2224/043 . . . electrorheological

2224/045 . . . magnetorheological

2224/046 . . . pneumatic

2224/048 . . . High viscosity, semi-solid pastiness (F16F 2224/041 takes precedence)

2226/00 Manufacturing; Treatments

2226/02 . Surface treatments

2226/023 . . . by laser or similar treatment by rays

2226/026 . . . low-friction

2226/04 . Assembly or fixing methods; methods to form or fashion parts

2226/041 . . . Clipping

2226/042 . Gluing

2226/044 . Snapping

2226/045 . Press-fitting

2226/047 . . . Sheet-metal stamping

2226/048 . . . Welding

2228/00 Functional characteristics, e.g. variability, frequency-dependence

2228/001 . . . Specific functional characteristics in numerical form or in the form of equations

2228/002 . . . Temperature

2228/004 . . . Force or pressure

2228/005 . . . Material properties, e.g. moduli

2228/007 . . . of solids, e.g. hardness

2228/008 . . . of semi-solids or fluids, e.g. viscosity

2228/009 . Frequency effects

2228/01 . . . Stiffness

2228/063 . . . Negative stiffness

2228/066 . Variable stiffness

2228/008 . . . pre-stressed

2228/10 . . . with threshold or dead zone

2228/12 . . . degressive

2228/14 . . . progressive

2230/00 Purpose; Design features

2230/005 . Attachment, e.g. to facilitate mounting onto confer adjustability

2230/0011 . Balancing, e.g. counterbalancing to produce static balance

2230/0017 . Calibrating

2230/0023 . protective

2230/0029 . Location, co-location

2230/0035 . Gripping

2230/0041 . Locking; Fixing in position

2230/0047 . Measuring, indicating

2230/0052 . Physically guiding or influencing

2230/0058 . . . using inserts or exterior elements, e.g. to affect stiffness

2230/0064 . . . using a cam

2230/007 . . . with, or used as an end stop or buffer; Limiting excessive axial separation

2230/0076 . . . Pivoting

2230/0082 . Dimensional tolerances, e.g. play between mechanical elements

2230/0088 . Timing

2230/0094 . Magnifying a physical effect

2230/02 . Surface features, e.g. notches or protuberances

2230/04 . Lubrication

2230/06 . Fluid filling or discharging

2230/08 . Sensor arrangement
Enclosure elements, e.g. for protection
Flexible, e.g. bellows or bladder
Gas generation, e.g. by mixing of chemicals
Ball joints; Spherical support elements
used in a strut, basically rigid
Control arrangements
fluid actuated
with manual adjustments
Location of equilibration chamber
Pumps
Detecting or preventing malfunction, e.g. fail safe
Air gap
Inclination of a suspension element
Sealing arrangements
Modular design
Flexural hinges
Holes, slots or the like
Off-centre positioning
Multi-layer
Multiple pistons
Maintenance
Thermal insulation

Nature of movement
Rotary
Rotary-to-translation conversion
Translation-to-rotary conversion
Linear

Shape
cylindrical
conical
plane or flat
spherical

Mode of stressing of basic spring or damper elements or devices incorporating such elements
the stressing resulting in flexion of the spring
of membrane-type springs
radial flexion of ring-type springs
of strip- or leg-type springs
Compression
the spring material being generally enclosed
Tension
Torsion
the spring being annular
Shear
linear
rotational
loaded in combined stresses
loaded in compression and shear
Neidhart-type rubber springs

Type of springs or dampers
Springs
leaf-like, e.g. of thin, planar-like metal
torsional
wound- or coil-like
Winding direction thereof
Damper
Lead shear damper