

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINEERING IN GENERAL

F16 ENGINEERING ELEMENTS AND UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL

F16F SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION

NOTES

- 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.
- 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 5/1426	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 }
- 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.
- 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

- 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

F16F

F16F

(continued)

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.

1/00	Springs (working with fluid F16F 5/00 , F16F 9/00)	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)}
1/02	. 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	1/127	. . . . {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)}
1/021	. . {characterised by their composition, e.g. comprising materials providing for particular spring properties (composition and manufacture of clock or watch springs G04B 1/145)}	1/13	. . . . comprising inserts and spacers between the windings for changing the mechanical or physical characteristics of the spring {(F16F 1/122 takes precedence)}
1/022	. . . {made of ceramic materials}	1/14	. . Torsion springs consisting of bars or tubes
1/024	. . {Covers or coatings therefor (F16F 1/24 takes precedence)}	1/145	. . . {with means for modifying the spring characteristics (fluid regulation of torsion spring characteristics in vehicle suspensions B60G 17/0277)}
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)}	1/16	. . . Attachments or mountings {(F16F 1/145 takes precedence; mounting means for vehicle stabiliser bars B60G 21/0551)}
1/027	. . . {Planar, e.g. in sheet form; leaf springs}	1/18	. . Leaf springs {(planar springs in general F16F 1/027 ; "Belleville"-type springs with generally radial arms F16F 1/324)}
1/028	. . . {cylindrical, with radial openings}	1/182	. . . {with inter-engaging portions between leaves or between leaves and mountings, e.g. ridges, notches, ripples}
1/04	. . Wound springs {(making springs by coiling wire B21F 3/00)}	1/185	. . . {characterised by shape or design of individual leaves (F16F 1/22 takes precedence)}
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)}	1/187	. . . . {shaped into an open profile, i.e. C- or U-shaped}
1/042	. . . {characterised by the cross-section of the wire}	1/20	. . . with layers, e.g. anti-friction layers, or with rollers between the leaves
1/043	. . . . {the cross-section varying with the wire length}	1/22	. . . with means for modifying the spring characteristic {(fluid regulation of leaf spring characteristics in vehicle suspensions B60G 17/0275)}
1/045	. . . {Canted-coil springs}	1/24	. . . Lubrication; Covers, e.g. for retaining lubricant
1/046	. . . {with partial nesting of inner and outer coils (F16F 3/04 takes precedence)}	1/26	. . . Attachments or mountings {(F16F 1/182 , F16F 1/22) B60G 11/10 take precedence}
1/047	. . . {characterised by varying pitch}	1/28	. . . . comprising cylindrical metal pins pivoted in close-fitting sleeves
1/048	. . . {with undulations, e.g. wavy springs}	1/30	. . . . comprising intermediate pieces made of rubber or similar elastic material
1/06	. . . with turns lying in cylindrical surfaces	1/32	. . Belleville-type springs (friction-clutch diaphragm springs F16D 13/583)
1/065	. . . . {characterised by loading of the coils in a radial direction (canted-coil springs F16F 1/045)}	1/322	. . . {Snap-action springs}
1/08	. . . with turns lying in mainly conical surfaces {, i.e. characterised by varying diameter (F16F 1/10 takes precedence)}	1/324	. . . {characterised by having tongues or arms directed in a generally radial direction, i.e. diaphragm-type springs}
1/10	. . . Spiral springs with turns lying substantially in plane surfaces {(F16F 1/326 takes precedence)}	1/326	. . . . {with a spiral-like appearance}
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)}	1/328	. . . {with undulations, e.g. wavy springs}
1/121	. . . . {adjustable, e.g. to modify spring characteristics}	1/34	. . Ring springs, i.e. annular bodies deformed radially due to axial load
1/122	. . . . {where coils, e.g. end coils, of the spring are rigidly clamped or similarly fixed}	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)}
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)}		

- 1/3605 . . {characterised by their material ([F16F 1/362](#), [F16F 1/364](#), [F16F 1/366](#), [F16F 1/37](#) take precedence; composition of macromolecular compounds in general [C08L](#))}
 - 1/361 . . . {comprising magneto-rheological elastomers [MR], (magneto-rheological fluid dampers [F16F 9/535](#))}
 - 1/3615 . . {with means for modifying the spring characteristic ([F16F 1/371](#) takes precedence)}
 - 1/362 . . made of steel wool, compressed hair, {woven or non-woven textile, or like materials}
 - 1/364 . . made of cork, wood or like material
 - 1/366 . . made of fibre-reinforced plastics, {i.e. characterised by their special construction from such materials}
- 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 1/3686](#).
- 1/3665 . . . {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 {(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 arrangements for controlling the spring temperature, e.g. by cooling

- 1/38 . . with a sleeve of elastic material between a rigid outer sleeve and a rigid inner sleeve or pin {, i.e. bushing-type (hydraulically-damped bushes [F16F 13/14](#); suppression of vibrations in rotating systems by making use of elastomeric spring members between rotating elements, driveline torque being transmitted therebetween [F16F 15/126](#), by making use of a dynamic damping mass attached to a rotating element by means of elastomeric springs [F16F 15/14](#); pivots *per se* [F16C 11/00](#); elastic or yielding bearings or bearing supports [F16C 27/00](#); parts of sliding-contact bearings, e.g. bushes [F16C 33/04](#))}
- 1/3807 . . . {characterised by adaptations for particular modes of stressing}
- 1/3814 {characterised by adaptations to counter axial forces ([F16F 1/393](#) takes precedence)}
- 1/3821 {characterised by adaptations to counter torsional forces}
- 1/3828 . . . {End stop features or buffering ([F16F 1/3807](#) takes precedence)}
- 1/3835 . . . {characterised by the sleeve of elastic material, e.g. having indentations or made of materials of different hardness ([F16F 1/3807](#), [F16F 1/387](#) take precedence)}
- 1/3842 . . . {Method of assembly, production or treatment; Mounting thereof (supports for pipes, cables or protective tubing [F16L 3/00](#))}
- 1/3849 {Mounting brackets therefor, e.g. stamped steel brackets; Restraining links}
- 1/3856 {Vulcanisation or gluing of interface between rigid and elastic sleeves}
- 1/3863 . . . {characterised by the rigid sleeves or pin, e.g. of non-circular cross-section ([F16F 1/3807](#), [F16F 1/387](#) take precedence)}
- 1/387 . . . comprising means for modifying the rigidity in particular directions {(spherical or conical sleeves [F16F 1/393](#))}
- 1/3873 {having holes or openings}
- 1/3876 {by means of inserts of more rigid material}
- 1/393 . . . with spherical or conical sleeves
- 1/3935 {Conical sleeves}
- 1/40 . . consisting of a stack of similar elements separated by non-elastic intermediate layers {([F16F 9/306](#) takes precedence; laminated constructions to protect buildings against abnormal external influences, e.g. earthquakes, [E04H 9/022](#))}
- 1/403 . . . {characterised by the shape of the non-elastic interengaging parts between the elements}
- 1/406 . . . {characterised by the shape of the elastic elements}
- 1/41 . . . the spring consisting of generally conically arranged elements {(if sleeve-like, i.e. a surface of revolution [F16F 1/3935](#))}
- 1/42 . . characterised by the mode 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](#).

- 1/422 . . . {the stressing resulting in flexion of the spring}
- 1/424 {of membrane-type springs}
- 1/426 {Radial flexion of ring-type springs}
- 1/428 {of strip- or leg-type springs}
- 1/44 . . . loaded mainly in compression
- 1/445 {the spring material being contained in a generally closed space ([F16F 1/393](#) takes precedence)}
- 1/46 . . . loaded mainly in tension
- 1/48 . . . loaded mainly in torsion
- 1/50 . . . loaded mainly in shear
- 1/505 {Rotational shear}
- 1/52 . . . loaded in combined stresses
- 1/54 loaded in compression and shear
- 1/545 {Neidhart-type rubber springs (vehicle suspensions having Neidhart-type rubber springs [B60G 11/225](#))}
- 3/00 Spring units consisting of several springs, e.g. for obtaining a desired spring characteristic** ([F16F 1/32](#), [F16F 1/34](#), [F16F 7/14](#) take precedence) ; if including fluid springs [F16F 5/00](#), [F16F 13/00](#))
- 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}
- 6/005 . {using permanent magnets only}
- 7/00 Vibration-dampers; Shock-absorbers** (using fluid [F16F 5/00](#), [F16F 9/00](#); specific for rotary systems [F16F 15/10](#) {; belt tensioners [F16H 7/12](#)})
- 7/003 . {One-shot shock absorbers (using plastic deformation of members, e.g. using sacrificial, fibre-reinforced composite members [F16F 7/12](#))}
- 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

- 7/12 . . . using plastic deformation of members [{\(F16F 9/30 takes precedence; yieldable means for mounting bumpers on vehicles B60R 19/26; yieldable or collapsible steering columns B62D 1/192\)}](#)
- 7/121 . . . {the members having a cellular, e.g. honeycomb, structure}
- 7/122 . . . {characterised by corrugations, e.g. of rolled corrugated material}
- 7/123 . . . {Deformation involving a bending action, e.g. strap moving through multiple rollers, folding of members [\(F16F 7/125, F16F 7/128 take precedence\)](#)}
- 7/124 . . . {characterised by their special construction from fibre-reinforced plastics}
- 7/125 . . . {Units with a telescopic-like action as one member moves into, or out of a second member [\(F16F 7/124, F16F 7/127, F16F 7/128 take precedence\)](#)}
- 7/126 . . . {against the action of shear pins; one member having protuberances, e.g. dimples, ball bearings which cause the other member to deform}
- 7/127 . . . {by a blade element cutting or tearing into a quantity of material; Pultrusion of a filling material}
- 7/128 . . . {characterised by the members, e.g. a flat strap, yielding through stretching, pulling apart}
- 7/14 . . . of cable support type, i.e. frictionally-engaged loop-forming cables
- 9/00 Springs, vibration-dampers, shock-absorbers, or similarly-constructed movement-dampers using a fluid or the equivalent as damping medium [\(F16F 5/00 takes precedence; connection of valves to inflatable elastic bodies B60C 29/00; {braking devices, stops or buffers for wing-operating appliances E05F 3/00, E05F 5/00}\)](#)**
- 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 [\(F16F 9/0227, F16F 9/0236, F16F 9/0245 take precedence\)](#)}
- 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 [{\(producing hollow articles of plastics, e.g. air bellows, B29D 22/00\)}](#)
- 9/0409 {characterised by the wall structure}
- 9/0418 {having a particular shape, e.g. annular, spherical, tube-like [\(F16F 9/05 takes precedence\)](#)}
- 9/0427 {toroidal}
- 9/0436 {characterised by being contained in a generally closed space}
- 9/0445 {characterised by intermediate rings or other not embedded reinforcing elements [\(wall structure F16F 9/0409\)](#)}
- 9/0454 {characterised by the assembling method or by the mounting arrangement, e.g. mounting of the membrane [\(F16F 9/0409, F16F 9/0445 take precedence\)](#)}
- 9/0463 {with separate crimping rings}
- 9/0472 {characterised by comprising a damping device [\(with plastic deformation of members F16F 7/12; delay devices or arrangements F15B 21/10\)](#)}
- 9/0481 {provided in an opening to the exterior atmosphere}
- 9/049 {multi-chamber units [\(F16F 9/0472, F16F 9/05 take precedence\)](#)}
- 9/05 the flexible wall being of the rolling diaphragm type
- 9/052 {characterised by the bumper}
- 9/055 {having a double diaphragm construction}
- 9/057 {characterised by the piston}
- 9/06 . . . using both gas and liquid [{\(F16F 9/486 take precedence; self-pumping fluid springs B60G 17/044\)}](#)
- 9/061 {Mono-tubular units}
- 9/062 {Bi-tubular units}
- 9/063 {comprising a hollow piston rod}
- 9/064 {Units characterised by the location or shape of the expansion chamber [\(F16F 9/068, F16F 9/08 take precedence\)](#)}
- 9/065 {Expansion chamber provided on the upper or lower end of a damper, separately there from or laterally on the damper}
- 9/066 {Units characterised by the partition, baffle or like element [\(F16F 9/068, F16F 9/08 take precedence\)](#)}
- 9/067 {Partitions of the piston type, e.g. sliding pistons}
- 9/068 {where the throttling of a gas flow provides damping action}
- 9/08 {where gas is} in a chamber with a flexible wall [{\(pressurised fluid system accumulators per se F15B 1/04\)}](#)
- 9/081 {being of the fluid displacement type, i.e. the piston not comprising damping arrangements [\(F16F 9/096 takes precedence\)](#)}
- 9/082 {characterised by the hydropneumatic accumulator}
- 9/084 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
- 9/088 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

- 9/092 . . . comprising a gas spring with a flexible wall provided between the tubes of a bitubular damper
- 9/096 . . . 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 ([F16F 9/088 takes precedence](#))
- 9/10 . . . using liquid only; using a fluid of which the nature is immaterial
- 9/103 . . {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](#))}
- 9/106 . . {Squeeze-tube devices}
- 9/12 . . 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](#))}
- 9/125 . . . {characterised by adjustment means}
- 9/14 . . Devices with one or more members, e.g. pistons, vanes, moving to and fro in chambers and using throttling effect
- 9/145 . . . {involving only rotary movement of the effective parts (wing closers or openers with fluid brakes of the rotary type [E05F 3/14](#))}
- 9/16 . . . involving only straight-line movement of the effective parts {([wing closers or openers with liquid piston brakes E05F 3/04](#))}
- 9/165 {with two or more cylinders in line, i.e. in series connection ([F16F 9/26 takes precedence](#))}
- 9/18 with a closed cylinder and a piston separating two or more working spaces therein
- 9/182 {comprising a hollow piston rod}
- 9/185 {Bitubular units (where compression of gas leads to a clear spring action [F16F 9/062](#))}
- 9/187 {with uni-directional flow of damping fluid through the valves}
- 9/19 with a single cylinder {and of single-tube type}
- 9/20 with the piston-rod extending through both ends of the cylinder {, e.g. constant-volume dampers}
- 9/22 with one or more cylinders each having a single working space closed by a piston or plunger
- 9/26 with two cylinders in line and with the two pistons or plungers connected together
- 9/28 with two parallel cylinders and with the two pistons or plungers connected together
- 9/285 {by a rocker arm}
- 9/30 . . . 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](#))}
- 9/303 . . {the damper being of the telescopic type}
- 9/306 . . {of the constrained layer type, i.e. comprising one or more constrained viscoelastic layers}
- 9/32 . . Details
- 9/3207 . . {Constructional features ([F16F 9/34 - F16F 9/50 take precedence](#); assembly or repair [F16F 9/3271](#))}
- 9/3214 {of pistons ([F16F 9/0227](#) and [F16F 9/36 take precedence](#); throttling passages in or on piston body [F16F 9/3405](#))}
- 9/3221 {of piston rods}
- 9/3228 {of connections between pistons and piston rods}
- 9/3235 {of cylinders ([F16F 9/483 takes precedence](#))}
- 9/3242 {of cylinder ends, e.g. caps}
- 9/325 {for attachment of valve units}
- 9/3257 {in twin-tube type devices}
- 9/3264 . . {Arrangements for indicating, e.g. fluid level; Arrangements for checking dampers ([F16F 9/3292 takes precedence](#); testing of vehicle damping [G01M 17/04](#))}
- 9/3271 . . {Assembly or repair}
- 9/3278 . . {for lubrication (lubricating *per se* [F16N](#))}
- 9/3285 . . {for filtering (filters *per se* [B01D](#))}
- 9/3292 . . {Sensor arrangements}
- 9/34 . . 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
- 9/3405 {Throttling passages in or on piston body, e.g. slots ([F16F 9/344](#), [F16F 9/3481 take precedence](#))}
- 9/341 {comprising noise-reducing or like features, e.g. screens ([F16F 9/3415 takes precedence](#))}
- 9/3415 {characterised by comprising plastics, elastomeric or porous elements}
- 9/342 Throttling passages operating with metering pins {([F16F 9/486 takes precedence](#))}
- 9/344 Vortex flow passages
- 9/346 Throttling passages in the form of slots arranged in cylinder walls
- 9/3465 {Slots having a variable section along their length}
- 9/348 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](#))}
- 9/3481 {characterised by shape or construction of throttling passages in piston ([F16F 9/344 takes precedence](#))}
- 9/3482 {the annular discs being incorporated within the valve or piston body ([F16F 9/3484](#), [F16F 9/3485 take precedence](#))}
- 9/3484 {characterised by features of the annular discs *per se*, singularly or in combination}
- 9/3485 {characterised by features of supporting elements intended to guide or limit the movement of the annular discs ([F16F 9/3488 takes precedence](#))}
- 9/3487 {with spacers or spacing rings}
- 9/3488 {characterised by features intended to affect valve bias or pre-stress}

- 9/36 . . 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 9/432](#) ; sealing of moving parts in general [F16J 15/16](#) - [F16J 15/56](#))
- 9/361 . . . {Sealings of the bellows-type}
- 9/362 . . . {Combination of sealing and guide arrangements for piston rods ([F16F 9/361](#), [F16F 9/365](#) take precedence)}
- 9/363 {the guide being mounted between the piston and the sealing, enabling lubrication of the guide}
- 9/364 {of multi-tube dampers}
- 9/365 . . . {the sealing arrangement having a pressurised chamber separated from the damping medium}
- 9/366 . . . {functioning as guide only, e.g. bushings}
- 9/367 {allowing misalignment of the piston rod}
- 9/368 . . . {Sealings in pistons}
- 9/369 . . . {Sealings for elements other than pistons or piston rods, e.g. valves}
- 9/38 . . Covers for protection or appearance
- 9/42 . . Cooling arrangements
- 9/43 . . Filling {or drainage} arrangements, e.g. for supply of gas {(filling vessels with, or discharging from vessels, compressed, liquefied, or solidified gases [F17C](#))}
- 9/432 . . . {via piston rod sealing or guiding means}
- 9/435 . . . {via opening in cylinder wall ([F16F 9/432](#) takes precedence)}
- 9/437 . . . {Drainage arrangements}
- 9/44 . . 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](#))
- 9/443 . . . {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}
- 9/446 . . . {Adjustment of valve bias or pre-stress ([F16F 9/443](#) takes precedence)}
- 9/46 . . . 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](#))}
- 9/461 {characterised by actuation means}
- 9/462 {Rotary actuation means}
- 9/463 {characterised by electrical connections}
- 9/464 {Control of valve bias or pre-stress, e.g. electromagnetically ([F16F 9/465](#) takes precedence)}
- 9/465 {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](#))}
- 9/466 {Throttling control, i.e. regulation of flow passage geometry ([F16F 9/464](#), [F16F 9/465](#) take precedence)}
- 9/467 {using rotary valves}
- 9/468 {controlling at least one bypass to main flow path}
- 9/469 {Valves incorporated in the piston ([F16F 9/467](#) takes precedence)}
- 9/48 . . Arrangements for providing different damping effects at different parts of the stroke ([F16F 9/346](#), [F16F 9/516](#) , [F16F 9/53](#) take precedence)
- 9/483 . . . {characterised by giving a particular shape to the cylinder, e.g. conical}
- 9/486 . . . {comprising a pin or stem co-operating with an aperture, e.g. a cylinder-mounted stem co-operating with a hollow piston rod}
- 9/49 . . . 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](#))}
- 9/50 . . 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}
- 9/504 . . . Inertia {, i.e. acceleration,}-sensitive means
- 9/512 . . . 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](#))}
- 9/5123 {responsive to the static or steady-state load on the damper}
- 9/5126 {Piston, or piston-like valve elements ([F16F 9/504](#) takes precedence)}
- 9/516 . . . 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)}
- 9/5165 {by use of spherical valve elements or like free-moving bodies}
- 9/52 . . . in case of change of temperature ({[F16F 9/003](#) takes precedence; } combined with external adjustment [F16F 9/44](#))
- 9/523 {with coil or spiral of bimetallic elements being used to change flow cross-section}
- 9/526 {Self-adjustment of fluid springs}
- 9/53 . . 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](#))}
- 9/532 . . . {Electrorheological [ER] fluid dampers}
- 9/535 . . . {Magnetorheological [MR] fluid dampers (springs comprising magnetorheological [MR] elastomers [F16F 1/361](#))}
- 9/537 {specially adapted valves therefor}

- 9/54 . . Arrangements for attachment { (grommet-type rubber mounting springs [per se F16F 1/3732](#); construction of cylinder ends [F16F 9/3242](#); attachments to vehicles [B60G 13/001](#), [B60G 15/00](#)) }
- 9/56 . . Means for adjusting the length of, or for locking, the spring or damper, e.g. at the end of the stroke { ([F16F 9/50](#) takes precedence; for telescopic gas springs or dampers [F16F 9/0245](#); vehicle suspension locking arrangements [B60G 17/005](#)) }
- 9/58 . . Stroke limiting stops, e.g. arranged on the piston rod outside the cylinder ([F16F 9/49](#) takes precedence)
- 9/585 . . . { within the cylinder, in contact with working fluid }
- 13/00 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)**
- 13/002 . { comprising at least one fluid spring ([F16F 13/005](#), [F16F 13/02](#), [F16F 13/04](#) take precedence) }
- 13/005 . { comprising both a wound spring and a damper, e.g. a friction damper }
- 13/007 . . { 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 }
- 13/1418 { characterised by the location or shape of the equilibration chamber }
- 13/1427 { characterised by features of flexible walls of equilibration chambers; decoupling or self-tuning means }
- 13/1436 { with free- or virtually free-floating members }
- 13/1445 { characterised by method of assembly, production or treatment }
- 13/1454 { Sealing of units }
- 13/1463 { characterised by features of passages between working chambers }
- 13/1472 { Valve elements to cope with over-pressure, e.g. lips }
- 13/1481 { 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 }
- 13/149 { Multiple bushings connected together; Restraining links }
- 13/16 specially adapted for receiving axial loads { ([F16F 13/1436](#) takes precedence) }
- 13/18 characterised by the location or the shape of the equilibration chamber, e.g. the equilibration chamber, surrounding the plastics spring or being annular ([F16F 13/1418](#) takes precedence)
- 13/20 . . . characterised by comprising also a pneumatic spring ([F16F 13/22](#), {[F16F 13/26](#)} take precedence)
- 13/22 . . . characterised by comprising also a dynamic damper (dampers using inertia effect [per se F16F 7/10](#))
- 13/24 . . . 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
- 13/26 . . characterised by adjusting or regulating devices responsive to exterior conditions { ([F16F 13/101](#) takes precedence) }
- 13/262 . . . { changing geometry of passages between working and equilibration chambers, e.g. cross-sectional area or length ([F16F 13/28](#) takes precedence) }
- 13/264 . . . { comprising means for acting dynamically on the walls bounding a working chamber }
- 13/266 . . . { comprising means for acting dynamically on the walls bounding a passage between working and equilibration chambers }
- 13/268 . . . { comprising means for acting dynamically on the walls bounding an equilibration chamber ([F16F 13/264](#) takes precedence) }
- 13/28 . . . specially adapted for units of the bushing type ([F16F 13/30](#) takes precedence)
- 13/30 . . . comprising means for varying fluid viscosity, e.g. of magnetic or electrorheological fluids
- 13/305 { magnetorheological }

- 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 magnetostrictive actuation means (generating of mechanical vibrations operating with electrostriction [B06B 1/06](#), with magnetostriction [B06B 1/08](#); vehicle suspension arrangements characterised by use of piezo-electric elements [B60G 17/01941](#); piezo-electric, electrostrictive and magnetostrictive 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 13/00](#)); ({[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 33/0604](#))}
- 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 3/00](#)}; 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 gyratory 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}

- 15/12313 {characterised by the dimension or shape of spring-containing windows}
- 15/1232 {characterised by the spring mounting ([F16F 15/12306](#), [F16F 15/12313](#) take precedence)}
- 15/12326 {End-caps for springs}
- 15/12333 {having internal abutment means}
- 15/1234 {Additional guiding means for springs, e.g. for support along the body of springs that extend circumferentially over a significant length}
- 15/12346 {Set of springs, e.g. springs within springs}
- 15/12353 {Combinations of dampers, e.g. with multiple plates, multiple spring sets, i.e. complex configurations}
- 15/1236 {resulting in a staged spring characteristic, e.g. with multiple intermediate plates}
- 15/12366 {acting on multiple sets of springs}
- 15/12373 {the sets of springs being arranged at substantially the same radius}
- 15/1238 {with pre-damper, i.e. additional set of springs between flange of main damper and hub}
- 15/12386 {Pre-damper cage construction}
- 15/12393 {pre-damper springs are of non-wound type, e.g. leaf springs}
- 15/124 Elastomeric springs ([F16F 15/123](#), [F16F 15/127](#) take precedence)
- 15/1245 {Elastic elements arranged between substantially-radial walls of two parts rotatable with respect to each other, e.g. between engaging teeth}
- 15/126 consisting of at least one annular element surrounding the axis of rotation
- 15/127 using plastics springs combined with other types of springs
- 15/129 characterised by friction-damping means ([F16F 15/1202](#), [F16F 15/1238](#) , [F16F 15/131](#) take precedence)
- 15/1292 {characterised by arrangements for axially clamping or positioning or otherwise influencing the frictional plates}
- 15/1295 {characterised by means for interconnecting driven plates and retainer, cover plates}
- 15/1297 {Overload protection, i.e. means for limiting torque}
- 15/131 the rotating system comprising two or more gyratory masses
- 15/13107 {for damping of axial or radial, i.e. non-torsional vibrations}
- 15/13114 {characterised by modifications for auxiliary purposes, e.g. provision of a timing mark}
- 15/13121 {characterised by clutch arrangements, e.g. for activation; integrated with clutch members, e.g. pressure member}
- 15/13128 {the damping action being at least partially controlled by centrifugal masses ([flywheels characterised by means to vary the moment of inertia F16F 15/31](#))}
- 15/13135 {simple connection or disconnection of members at speed}
- 15/13142 {characterised by the method of assembly, production or treatment ([F16F 15/13114](#) takes precedence)}
- 15/1315 {Multi-part primary or secondary masses, e.g. assembled from pieces of sheet steel}
- 15/13157 {with a kinematic mechanism or gear system, e.g. planetary ([F16F 15/13128](#) takes precedence)}
- 15/13164 {characterised by the supporting arrangement of the damper unit}
- 15/13171 {Bearing arrangements ([F16F 15/13192](#) takes precedence)}
- 15/13178 {comprising slide bearings}
- 15/13185 {Bolting arrangements ([F16F 15/13171](#) takes precedence)}
- 15/13192 {Thermal shielding}
- 15/133 using springs as elastic members, e.g. metallic springs
- 15/1331 {C-shaped springs}
- 15/1332 {disposed around axis of rotation}
- 15/1333 {Spiral springs, e.g. lying in one plane, around axis of rotation}
- 15/1335 {Folded springs, i.e. made of band-like material folded in an enclosing space}
- 15/1336 {Leaf springs, e.g. radially extending}
- 15/1337 {Torsional springs, e.g. torsion bar or torsionally-loaded coil springs}
- 15/1338 {Motion-limiting means, e.g. means for locking the spring unit in pre-defined positions ([F16F 15/13128](#) takes precedence)}
- 15/134 Wound springs ([F16F 15/1333](#), [F16F 15/1337](#), [F16F 15/137](#) take precedence)}
- 15/13407 {Radially mounted springs}
- 15/13415 {characterised by the dimension or shape of spring-containing windows}
- 15/13423 {Disposition of material for damping or avoiding wear}
- 15/1343 {characterised by the spring mounting ([F16F 15/13407](#), [F16F 15/13415](#) take precedence)}
- 15/13438 {End-caps for springs}
- 15/13446 {having internal abutment means}
- 15/13453 {Additional guiding means for springs}
- 15/13461 {Set of springs, e.g. springs within springs}
- 15/13469 {Combinations of dampers, e.g. with multiple plates, multiple spring sets, i.e. complex configurations}
- 15/13476 {resulting in a staged spring characteristic, e.g. with multiple intermediate plates}
- 15/13484 {acting on multiple sets of springs}
- 15/13492 {the sets of springs being arranged at substantially the same radius}
- 15/136 Plastics springs, e.g. made of rubber ([F16F 15/134](#), [F16F 15/137](#) take precedence)
- 15/137 the elastic members consisting of two or more springs of different kinds, {e.g. elastomeric members and wound springs}

- 15/139 characterised by friction-damping means
{(F16F 15/13128 takes precedence)}
- 15/1392 {characterised by arrangements for axially
clamping or positioning or otherwise
influencing the frictional plates}
- 15/1395 {characterised by main friction means
acting radially outside the circumferential
lines of action of the elastic members}
- 15/1397 {Overload protection, i.e. means for
limiting torque}
- 15/14 . . using masses freely rotating with the system,
{i.e. uninvolved in transmitting driveline torque,
e.g. rotative dynamic dampers (compensation of
inertia forces F16F 15/22; weights for balancing
rotating bodies F16F 15/32)}
- 15/1407 . . . {the rotation being limited with respect to the
driving means}
- 15/1414 {Masses driven by elastic elements
(F16F 15/145, F16F 15/1464 take
precedence)}
- 15/1421 {Metallic springs, e.g. coil or spiral
springs}
- 15/1428 {with a single mass}
- 15/1435 {Elastomeric springs, i.e. made of plastic
or rubber}
- 15/1442 {with a single mass}
- 15/145 {Masses mounted with play with respect to
driving means thus enabling free movement
over a limited range}
- 15/1457 {Systems with a single mass}
- 15/1464 {Masses connected to driveline by a
kinematic mechanism or gear system
(F16F 15/145 takes precedence)}
- 15/1471 {with a kinematic mechanism, i.e.
linkages, levers}
- 15/1478 {with a planetary gear system}
- 15/1485 . . . {the rotation being unlimited with respect to
driving means (with a fluid connection between
inertia member and rotating driving means
F16F 15/167)}
- 15/1492 {with a dry-friction connection}
- 15/16 . . using a fluid {or pasty material} (F16F 9/53,
F16F 15/13157 take precedence; devices
connecting input and output members F16D)
- 15/161 . . . {characterised by the fluid damping devices,
e.g. passages, orifices (F16F 15/162 takes
precedence)}
- 15/162 . . . {with forced fluid circulation}
- 15/163 . . . {fluid acting as a lubricant}
- 15/164 . . . {characterised by manufacturing, e.g.
assembling or testing procedures}
- 15/165 . . . {Sealing arrangements}
- 15/167 . . . having an inertia member, e.g. ring
- 15/173 provided within a closed housing
{(F16F 15/36 takes precedence)}
- 15/18 . . using electric, {magnetic or electromagnetic}
means ({suppression of vibrations of rotating
systems by use of non-rotating magnetic or
electromagnetic means F16F 15/03; } dynamo-
electric devices H02K; {control effected upon
generator excitation circuit to reduce harmful
effects of overloads or transients H02P 9/10})
- 15/20 . . Suppression of vibrations of rotating systems by
favourable grouping or relative arrangements of
the moving members of the system or systems
{(F16F 15/24 takes precedence)}
- 15/22 . . Compensation of inertia forces {(suppression
of vibrations of rotating systems by favourable
grouping or relative arrangements of the moving
members of the system or systems F16F 15/20,
counterweights F16F 15/28; correcting-weights for
balancing rotating bodies F16F 15/32)}
- 15/223 . . {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 B06B 1/166)}
- 15/226 . . {in star engine arrangements}
- 15/24 . . of crankshaft systems by particular disposition of
cranks, pistons, or the like {(shape of crankshafts
or eccentric-shafts having regard to balancing
F16C 3/20)}
- 15/26 . . of crankshaft systems using solid masses, other
than the ordinary pistons, moving with the system
{, i.e. masses connected through a kinematic
mechanism or gear system (F16F 15/226 takes
precedence)}
- 15/261 . . . {where masses move linearly}
- 15/262 . . . {Masses attached to pinions, camshafts or
driving shafts for auxiliary equipment, e.g. for
an oil pump}
- 15/264 . . . {Rotating balancer shafts (F16F 15/262 takes
precedence)}
- 15/265 {Arrangement of two or more balancer shafts
(F16F 15/267 takes precedence)}
- 15/267 {characterised by bearing support of balancer
shafts; Lubrication arrangements}
- 15/268 {Hollow shafts}
- 15/28 . . Counterweights, {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 F16F 15/264; correcting-
weights for balancing rotating bodies F16F 15/32)};
Attaching or mounting same
- 15/283 . . {for engine crankshafts}
- 15/286 . . . {Adjustable weights}
- 15/30 . . Flywheels (F16F 15/16, F16F 15/28 take
precedence; suppression of vibrations in rotating
systems using elastic members or friction-damping
members moving with the system, {i.e. split
flywheels or single masses connected to a hub by
elastic members or friction-damping members}
F16F 15/12; rotary-body aspects in general
F16C 13/00, F16C 15/00)
- 15/302 . . {comprising arrangements for cooling or thermal
insulation}
- 15/305 . . made of plastics, e.g. fibre-reinforced plastics
[FRP], {i.e. characterised by their special
construction from such materials}
- 15/31 . . characterised by means for varying the moment of
inertia
- 15/315 . . characterised by their supporting arrangement,
e.g. mountings, cages, securing inertia member to
shaft (F16F 15/31 takes precedence)
- 15/3153 . . . {Securing inertia members to the shafts}
- 15/3156 . . . {Arrangement of the bearings}

15/32	<ul style="list-style-type: none"> 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)} 	2224/043	<ul style="list-style-type: none"> electrorheological
15/322	<ul style="list-style-type: none"> {the rotating body being a shaft (F16F 15/34, F16F 15/36 take precedence)} 	2224/045	<ul style="list-style-type: none"> magnetorheological
15/324	<ul style="list-style-type: none"> {the rotating body being a vehicle wheel (F16F 15/36 takes precedence; tyre parts or constructions not otherwise provided for B60C 19/00)} 	2224/046	<ul style="list-style-type: none"> pneumatic
15/326	<ul style="list-style-type: none"> {specially adapted for attachment to spokes} 	2224/048	<ul style="list-style-type: none"> High viscosity, semi-solid pastiness (F16F 2224/041 takes precedence)
15/328	<ul style="list-style-type: none"> {Multiple weights on adhesive strip} 	2226/00	Manufacturing; Treatments
15/34	<ul style="list-style-type: none"> Fastening arrangements therefor 	2226/02	<ul style="list-style-type: none"> Surface treatments
	NOTE	2226/023	<ul style="list-style-type: none"> by laser or similar treatment by rays
	Hand held gripping tools B25B 7/00	2226/026	<ul style="list-style-type: none"> low-friction
15/345	<ul style="list-style-type: none"> {specially adapted for attachment to a vehicle wheel} 	2226/04	<ul style="list-style-type: none"> Assembly or fixing methods; methods to form or fashion parts
15/36	<ul style="list-style-type: none"> 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)} 	2226/041	<ul style="list-style-type: none"> Clipping
15/363	<ul style="list-style-type: none"> {using rolling bodies, e.g. balls free to move in a circumferential direction} 	2226/042	<ul style="list-style-type: none"> Gluing
15/366	<ul style="list-style-type: none"> {using fluid or powder means, i.e. non-discrete material} 	2226/044	<ul style="list-style-type: none"> Snapping
2222/00	Special physical effects, e.g. nature of damping effects	2226/045	<ul style="list-style-type: none"> Press-fitting
2222/02	<ul style="list-style-type: none"> temperature-related (F16F 2228/002 takes precedence) 	2226/047	<ul style="list-style-type: none"> Sheet-metal stamping
2222/025	<ul style="list-style-type: none"> Cooling 	2226/048	<ul style="list-style-type: none"> Welding
2222/04	<ul style="list-style-type: none"> Friction 	2228/00	Functional characteristics, e.g. variability, frequency-dependence
2222/06	<ul style="list-style-type: none"> Magnetic or electromagnetic 	2228/001	<ul style="list-style-type: none"> Specific functional characteristics in numerical form or in the form of equations
2222/08	<ul style="list-style-type: none"> Inertia 	2228/002	<ul style="list-style-type: none"> Temperature
2222/10	<ul style="list-style-type: none"> Adhesion 	2228/004	<ul style="list-style-type: none"> Force or pressure
2222/12	<ul style="list-style-type: none"> Fluid damping 	2228/005	<ul style="list-style-type: none"> Material properties, e.g. moduli
2222/123	<ul style="list-style-type: none"> decreasing with increasing flow 	2228/007	<ul style="list-style-type: none"> of solids, e.g. hardness
2222/126	<ul style="list-style-type: none"> using gases 	2228/008	<ul style="list-style-type: none"> of semi-solids or fluids, e.g. viscosity
2222/14	<ul style="list-style-type: none"> superconducting 	2228/04	<ul style="list-style-type: none"> Frequency effects
2224/00	Materials; Material properties	2228/06	<ul style="list-style-type: none"> Stiffness
2224/005	<ul style="list-style-type: none"> Combined materials of same basic nature but differing characteristics 	2228/063	<ul style="list-style-type: none"> Negative stiffness
2224/02	<ul style="list-style-type: none"> solids 	2228/066	<ul style="list-style-type: none"> Variable stiffness
2224/0208	<ul style="list-style-type: none"> Alloys 	2228/08	<ul style="list-style-type: none"> pre-stressed
2224/0216	<ul style="list-style-type: none"> bimetallic 	2228/10	<ul style="list-style-type: none"> with threshold or dead zone
2224/0225	<ul style="list-style-type: none"> Cellular, e.g. microcellular foam 	2228/12	<ul style="list-style-type: none"> degressive
2224/0233	<ul style="list-style-type: none"> deforming plastically in operation 	2228/14	<ul style="list-style-type: none"> progressive
2224/0241	<ul style="list-style-type: none"> Fibre-reinforced plastics [FRP] 	2230/00	Purpose; Design features
2224/025	<ul style="list-style-type: none"> Elastomers 	2230/0005	<ul style="list-style-type: none"> Attachment, e.g. to facilitate mounting onto confer adjustability
2224/0258	<ul style="list-style-type: none"> Shape-memory metals, e.g. Ni-Ti alloys 	2230/0011	<ul style="list-style-type: none"> Balancing, e.g. counterbalancing to produce static balance
2224/0266	<ul style="list-style-type: none"> porosity 	2230/0017	<ul style="list-style-type: none"> Calibrating
2224/0275	<ul style="list-style-type: none"> Ceramics 	2230/0023	<ul style="list-style-type: none"> protective
2224/0283	<ul style="list-style-type: none"> piezoelectric; electro- or magnetostrictive 	2230/0029	<ul style="list-style-type: none"> Location, co-location
2224/0291	<ul style="list-style-type: none"> PTFE 	2230/0035	<ul style="list-style-type: none"> Gripping
2224/04	<ul style="list-style-type: none"> Fluids 	2230/0041	<ul style="list-style-type: none"> Locking; Fixing in position
2224/041	<ul style="list-style-type: none"> Dilatant 	2230/0047	<ul style="list-style-type: none"> Measuring, indicating
		2230/0052	<ul style="list-style-type: none"> Physically guiding or influencing
		2230/0058	<ul style="list-style-type: none"> using inserts or exterior elements, e.g. to affect stiffness
		2230/0064	<ul style="list-style-type: none"> using a cam
		2230/007	<ul style="list-style-type: none"> with, or used as an end stop or buffer; Limiting excessive axial separation
		2230/0076	<ul style="list-style-type: none"> Pivoting
		2230/0082	<ul style="list-style-type: none"> Dimensional tolerances, e.g. play between mechanical elements
		2230/0088	<ul style="list-style-type: none"> Timing
		2230/0094	<ul style="list-style-type: none"> Magnifying a physical effect
		2230/02	<ul style="list-style-type: none"> Surface features, e.g. notches or protuberances
		2230/04	<ul style="list-style-type: none"> Lubrication
		2230/06	<ul style="list-style-type: none"> Fluid filling or discharging
		2230/08	<ul style="list-style-type: none"> Sensor arrangement

- 2230/10 . Enclosure elements, e.g. for protection
- 2230/105 . . Flexible, e.g. bellows or bladder
- 2230/12 . Gas generation, e.g. by mixing of chemicals
- 2230/14 . Ball joints; Spherical support elements
- 2230/16 . used in a strut, basically rigid
- 2230/18 . Control arrangements
- 2230/183 . . fluid actuated
- 2230/186 . . with manual adjustments
- 2230/20 . Location of equilibration chamber
- 2230/22 . Pumps
- 2230/24 . Detecting or preventing malfunction, e.g. fail safe
- 2230/26 . Air gap
- 2230/28 . Inclination of a suspension element
- 2230/30 . Sealing arrangements
- 2230/32 . Modular design
- 2230/34 . Flexural hinges
- 2230/36 . Holes, slots or the like
- 2230/38 . Off-centre positioning
- 2230/40 . Multi-layer
- 2230/42 . Multiple pistons
- 2230/46 . Maintenance
- 2230/48 . Thermal insulation

2232/00 Nature of movement

- 2232/02 . Rotary
- 2232/04 . Rotary-to-translation conversion
- 2232/06 . Translation-to-rotary conversion
- 2232/08 . Linear

2234/00 Shape

- 2234/02 . cylindrical
- 2234/04 . conical
- 2234/06 . plane or flat
- 2234/08 . spherical

2236/00 Mode of stressing of basic spring or damper elements or devices incorporating such elements

- 2236/02 . the stressing resulting in flexion of the spring
- 2236/022 . . of membrane-type springs
- 2236/025 . . radial flexion of ring-type springs
- 2236/027 . . of strip- or leg-type springs
- 2236/04 . Compression
- 2236/045 . . the spring material being generally enclosed
- 2236/06 . Tension
- 2236/08 . Torsion
- 2236/085 . . the spring being annular
- 2236/10 . Shear
- 2236/103 . . linear
- 2236/106 . . rotational
- 2236/12 . loaded in combined stresses
- 2236/123 . . loaded in compression and shear
- 2236/126 . . . Neidhart-type rubber springs

2238/00 Type of springs or dampers

- 2238/02 . Springs
- 2238/022 . . leaf-like, e.g. of thin, planar-like metal
- 2238/024 . . torsional
- 2238/026 . . wound- or coil-like
- 2238/028 . . . Winding direction thereof
- 2238/04 . Damper
- 2238/045 . . Lead shear damper