SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

F16 ENGINEERING ELEMENTS OR 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

Note(s) [5]

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 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
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 1/15.....Marine propellers having vibration-damping means
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
F03G 1/00.....Spring motors
F21V 15/04.....Resilient mounting of lighting devices
F41A 25/00.....Gun cradles to permit recoil
F41B 5/20.....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 displacable control elements in nuclear reactors.

Subclass index

SPRINGS
Friction type; fluid type; magnetic type.....1/00, 3/00, 5/00, 9/00, 6/00
VIBRATION-DAMPERS OR SHOCK-ABSORBERS
Friction type; fluid type.....7/00, 11/00, 9/00, 11/00
UNITS COMBINING SPRINGS AND VIBRATION-DAMPERS OR SHOCK-ABSORBERS.....13/00
SUPPRESSION OF VIBRATION, BALANCING.....15/00

1/00 **Springs** (working with fluid F16F 5/00, F16F 9/00) **[1, 2006.01]**

1/02 • made of steel or other material having low internal friction (F16F 1/36 takes precedence); Wound, torsion, leaf, cup, ring or the like springs, the material of the spring not being relevant **[1, 6, 2006.01]**

1/04 • • Wound springs **[1, 2006.01]**

1/06 • • • with turns lying in cylindrical surfaces **[1, 2006.01]**

1/08 • • • with turns lying in mainly conical surfaces **[1, 2006.01]**

1/10 • • • Spiral springs with turns lying substantially in plane surfaces **[1, 2006.01]**

1/12 • • • Attachments or mountings **[1, 2006.01]**

1/13 • • • • comprising inserts or spacers between the windings for changing the mechanical or physical characteristics of the spring **[6, 2006.01]**

1/14 • • Torsion springs consisting of bars or tubes **[1, 2006.01]**
1/16 • • • Attachments or mountings **[1, 2006.01]**
1/18 • • Leaf springs **[1, 2006.01]**
1/20 • • • with layers, e.g. anti-friction layers, or with rollers between the leaves **[1, 2006.01]**
1/22 • • • with means for modifying the spring characteristic **[1, 2006.01]**
1/24 • • • Lubrication; Covers, e.g. for retaining lubricant **[1, 2006.01]**
1/26 • • • Attachments or mountings (B60G 11/10 takes precedence) **[1, 5, 2006.01]**
1/28 • • • • comprising cylindrical metal pins pivoted in close-fitting sleeves **[1, 2006.01]**
1/30 • • • • comprising intermediate pieces made of rubber or similar elastic material **[1, 2006.01]**
1/32 • • Cup springs; Dished disc springs (diaphragms F16J 3/00) **[1, 2006.01]**
1/34 • • Ring springs, i.e. annular bodies deformed radially due to axial load **[1, 2006.01]**
1/36 • made of plastics, e.g. rubber; made of material having high internal friction **[1, 2006.01]**
1/362 • • made of steel wool or compressed hair **[6, 2006.01]**
1/364 • • made of cork, wood or the like material **[6, 2006.01]**
1/366 • • made of fibre reinforced plastics **[6, 2006.01]**
1/368 • • • Leaf springs **[6, 2006.01]**
1/37 • • of foam-like material, e.g. sponge rubber **[1, 2006.01]**
1/371 • • characterised by inserts or auxiliary extension elements, e.g. for rigidification (F16F 1/366, F16F 1/387 take precedence) **[6, 2006.01]**
1/373 • • characterised by having a particular shape **[6, 2006.01]**
1/374 • • • having a spherical or the like shape **[6, 2006.01]**
1/376 • • • having projections, studs, serrations or the like on at least one surface (F16F 1/387 takes precedence) **[6, 2006.01]**
1/377 • • • having holes or openings (F16F 1/387 takes precedence) **[6, 2006.01]**
1/379 • • characterised by arrangements for regulating the spring temperature, e.g. by cooling **[6, 2006.01]**
1/38 • • with a sleeve of elastic material between a rigid outer sleeve and a rigid inner sleeve or pin **[1, 2006.01]**
1/387 • • • comprising means for modifying the rigidity in particular directions **[6, 2006.01]**
1/393 • • • with spherical or conical sleeves **[6, 2006.01]**
1/40 • • consisting of a stack of similar elements separated by non-elastic intermediate layers **[1, 2006.01]**
1/41 • • • the spring consisting of generally conically arranged elements **[6, 2006.01]**
1/42 • • characterised by the mode of stressing **[1, 2006.01]**
1/44 • • • loaded mainly in compression **[1, 2006.01]**
1/46 • • • loaded mainly in tension **[1, 2006.01]**
1/48 • • • loaded mainly in torsion **[1, 2006.01]**
1/50 • • • loaded mainly in shear **[1, 2006.01]**
1/52 • • • loaded in combined stresses **[1, 2006.01]**
1/54 • • • • loaded in compression and shear **[1, 2006.01]**

3/00 Spring units consisting of several springs, e.g. for obtaining a desired spring characteristic (including fluid springs F16F 5/00, F16F 13/00) **[1, 2006.01]**
3/02 • with springs made of steel or of other material having low internal friction **[1, 2006.01]**
3/04 • • composed only of wound springs **[1, 2006.01]**
3/06 • • • of which some are placed around others in such a way that they damp each other by mutual friction **[1, 2006.01]**
3/07 • • combined with chambers filled with gas or liquid **[1, 2006.01]**
3/08 • with springs made of a material having high internal friction, e.g. rubber **[1, 2006.01]**
3/087 • • Units comprising several springs made of plastics or the like material (F16F 1/40 takes precedence) **[6, 2006.01]**
3/093 • • • the springs being of different materials, e.g. having different types of rubber **[6, 2006.01]**
3/10 • • combined with springs made of steel or other material having low internal friction **[1, 2006.01]**
3/12 • • • the steel spring being in contact with the rubber spring, e.g. being embedded in it **[6, 2006.01]**

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 [1, 2006.01]

6/00 Magnetic springs; Fluid magnetic springs [1, 2006.01]

7/00 Vibration-dampers; Shock-absorbers (using fluid F16F 5/00, F16F 9/00; specific for rotary systems F16F 15/10) **[1, 2006.01]**
7/01 • using friction between loose particles, e.g. sand **[6, 2006.01]**
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) **[1, 6, 2006.01]**
7/04 • • in the direction of the axis of rotation **[1, 2006.01]**
7/06 • • in a direction perpendicular or inclined to the axis of rotation **[1, 2006.01]**
7/08 • with friction surfaces rectilinearly movable along each other (F16F 7/01 takes precedence) **[1, 6, 2006.01]**
7/09 • • in dampers of the cylinder-and-piston type **[6, 2006.01]**
7/10 • using inertia effect **[1, 2006.01]**
7/104 • • the inertia member being resiliently mounted **[6, 2006.01]**
7/108 • • • on plastics springs **[6, 2006.01]**
7/112 • • • on fluid springs **[6, 2006.01]**
7/116 • • • on metal springs **[6, 2006.01]**
7/12 • using plastic deformation of members **[1, 2006.01]**
7/14 • of cable-support type, i.e. frictionally-engaged loop-forming cables **[1, 2006.01]**

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; door-operating appliances with fluid braking systems E05F) **[1, 2006.01]**
9/02 • using gas only **[1, 2006.01]**
9/04 • • in a chamber with a flexible wall **[1, 2006.01]**

9/05 • • • the flexible wall being of the rolling diaphragm type **[5, 2006.01]**
9/06 • using both gas and liquid **[1, 2006.01]**
9/08 • • in a chamber with a flexible wall **[1, 2006.01]**
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 **[6, 2006.01]**
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 **[6, 2006.01]**
9/092 • • • comprising a gas spring with a flexible wall provided between the tubes of a bitubular damper **[6, 2006.01]**
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 **[6, 2006.01]**
9/10 • using liquid only; using a fluid of which the nature is immaterial **[1, 2006.01]**
9/12 • • Devices with one or more rotary vanes turning in the fluid, any throttling effect being immaterial **[1, 2006.01]**
9/14 • • Devices with one or more members, e.g. pistons, vanes, moving to and fro in chambers and using throttling effect **[1, 2006.01]**
9/16 • • • involving only straight-line movement of the effective parts **[1, 2006.01]**
9/18 • • • • with a closed cylinder and a piston separating two or more working spaces therein **[1, 2006.01]**
9/19 • • • • • with a single cylinder **[1, 2006.01]**
9/20 • • • • • with the piston-rod extending through both ends of the cylinder **[1, 2006.01]**
9/22 • • • • with one or more cylinders, each having a single working space closed by a piston or plunger **[1, 2006.01]**
9/24 • • • • • with a single cylinder and a single piston or plunger **[1, 2006.01]**
9/26 • • • • • with two cylinders in line and with the two pistons or plungers connected together **[1, 2006.01]**
9/28 • • • • • with two parallel cylinders and with the two pistons or plungers connected together **[1, 2006.01]**
9/30 • with solid or semi-solid material, e.g. pasty masses, as damping medium **[1, 2006.01]**
9/32 • Details **[1, 2006.01]**
9/34 • • Special valve constructions (valves in general F16K); Shape or construction of throttling passages **[1, 2006.01]**
9/342 • • • Throttling passages operating with metering pins **[1, 2006.01]**
9/344 • • • Vortex flow passages **[6, 2006.01]**
9/346 • • • Throttling passages in the form of slots arranged in cylinder walls **[1, 2006.01]**
9/348 • • • Throttling passages in the form of annular discs operating in opposite directions **[1, 2006.01]**
9/36 • • Special sealings, including sealings or guides for piston-rods **[1, 2006.01]**
9/38 • • Covers for protection or appearance **[1, 2006.01]**
9/40 • • Arrangements for preventing froth **[1, 2006.01]**
9/42 • • Cooling arrangements **[1, 2006.01]**
9/43 • • Filling arrangements, e.g. for supply of gas **[1, 2006.01]**
9/44 • • Means on or in the damper for manual or non-automatic adjustment; such means combined with temperature correction (F16F 9/53, F16F 9/56 take precedence; temperature correction only F16F 9/52) **[1, 5, 6, 2006.01]**
9/46 • • • allowing control from a distance **[1, 2006.01]**
9/48 • • Arrangements for providing different damping effects at different parts of the stroke (F16F 9/53, F16F 9/56 take precedence) **[1, 5, 6, 2006.01]**
9/49 • • • Stops limiting fluid passage, e.g. hydraulic stops **[1, 2006.01]**
9/50 • • Special means providing automatic damping adjustment (F16F 9/53, F16F 9/56 take precedence) **[1, 5, 6, 2006.01]**
9/504 • • • Inertia-sensitive means **[6, 2006.01]**
9/508 • • • Means responsive to the velocity of movement of the piston **[6, 2006.01]**
9/512 • • • Means responsive to load action on the damper or fluid pressure in the damper **[6, 2006.01]**
9/516 • • • resulting in the damping effects during contraction being different from the damping effects during extension **[6, 2006.01]**
9/52 • • • in case of change of temperature (combined with external adjustment F16F 9/44) **[1, 2006.01]**
9/53 • • Means for adjusting damping characteristics by varying fluid viscosity, e.g. electromagnetically **[5, 2006.01]**
9/54 • • Arrangements for attachment **[1, 2006.01]**
9/56 • • Means for adjusting the length of, or for locking, the spring or damper, e.g. at the end of the stroke **[6, 2006.01]**
9/58 • • Stroke limiting stops, e.g. arranged on the piston rod outside the cylinder (F16F 9/49 takes precedence) **[6, 2006.01]**

11/00 Vibration-dampers or shock-absorbers working with both friction and a damping fluid [1, 2006.01]

13/00 Units comprising springs of the non-fluid type as well as vibration-dampers, shock-absorbers, or fluid springs (F16F 5/00 takes precedence) **[1, 2006.01]**
13/02 • damping by frictional contact between the spring and braking means (frictionally coacting wound springs F16F 3/06) **[1, 2006.01]**
13/04 • comprising both a plastics spring and a damper, e.g. a friction damper **[6, 2006.01]**
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) **[6, 2006.01]**
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) **[6, 2006.01]**
13/10 • • • • the wall being at least in part formed by a flexible membrane or the like (F16F 13/12-F16F 13/18 take precedence) **[6, 2006.01]**
13/12 • • • • Single chamber dampers (F16F 13/14 takes precedence) **[6, 2006.01]**
13/14 • • • • Units of the bushing type **[6, 2006.01]**
13/16 • • • • • specially adapted for receiving axial loads **[6, 2006.01]**
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 13/14 takes precedence) **[6, 2006.01]**

13/20 • • • characterised by comprising also a pneumatic spring (F16F 13/22 takes precedence) **[6, 2006.01]**

13/22 • • • characterised by comprising also a dynamic damper (dampers using inertia effect per se F16F 7/10) **[6, 2006.01]**

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 **[6, 2006.01]**

13/26 • • characterised by adjusting or regulating devices responsive to exterior conditions **[6, 2006.01]**

13/28 • • • specially adapted for units of the bushing type (F16F 13/30 takes precedence) **[6, 2006.01]**

13/30 • • • comprising means for varying fluid viscosity, e.g. of magnetic or electrorheological fluids **[6, 2006.01]**

15/00 **Suppression of vibrations in systems** (vehicle seat suspension devices B60N 2/50)**; Means or arrangements for avoiding or reducing out-of-balance forces, e.g. due to motion** (testing static or dynamic balance of machines or structures G01M 1/00) **[1, 2006.01]**

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 system (layered products B32B; suppression of vibration in ships B63) **[1, 2006.01]**

15/023 • • using fluid means **[6, 2006.01]**

15/027 • • • comprising control arrangements **[6, 2006.01]**

15/03 • • using electromagnetic means (F16F 9/53 takes precedence) **[1, 5, 2006.01]**

15/04 • • using elastic means (single elements or their attachment F16F 1/00-F16F 13/00) **[1, 2, 2006.01]**

15/06 • • • with metal springs (with rubber springs also F16F 15/08) **[1, 2006.01]**

15/067 • • • • using only wound springs **[6, 2006.01]**

15/073 • • • • using only leaf springs **[6, 2006.01]**

15/08 • • • with rubber springs **[1, 2006.01]**

15/10 • Suppression of vibrations in rotating systems by making use of members moving with the system (by balancing F16F 15/22; with flywheels acting variably or intermittently F16H) **[1, 2006.01]**

15/12 • • using elastic members or friction-damping members, e.g. between a rotating shaft and a gyratory mass mounted thereon (F16F 15/16 takes precedence) **[1, 6, 2006.01]**

15/121 • • • using springs as elastic members, e.g. metallic springs (F16F 15/131 takes precedence) **[6, 2006.01]**

15/123 • • • • Wound springs **[6, 2006.01]**

15/124 • • • • Plastics springs, e.g. made of rubber (F16F 15/123 takes precedence) **[6, 2006.01]**

15/126 • • • • • consisting of at least one annular element surrounding the axis of rotation **[6, 2006.01]**

15/127 • • • • using plastics springs combined with other types of springs **[6, 2006.01]**

15/129 • • • characterised by friction-damping means (F16F 15/131 takes precedence) **[6, 2006.01]**

15/131 • • • the rotating system comprising two or more gyratory masses **[6, 2006.01]**

15/133 • • • • using springs as elastic members, e.g. metallic springs **[6, 2006.01]**

15/134 • • • • • Wound springs **[6, 2006.01]**

15/136 • • • • • Plastics springs, e.g. made of rubber (F16F 15/134 takes precedence) **[6, 2006.01]**

15/137 • • • • • the elastic members consisting of two or more springs of different types **[6, 2006.01]**

15/139 • • • • characterised by friction-damping means **[6, 2006.01]**

15/14 • • using freely-swinging masses rotating with the system **[1, 2006.01]**

15/16 • • using a fluid (devices connecting input and output members F16D) **[1, 2006.01]**

15/167 • • • having an inertia member, e.g. ring **[6, 2006.01]**

15/173 • • • • provided within a closed housing **[6, 2006.01]**

15/18 • • using electric means (dynamo-electric devices H02K) **[1, 2006.01]**

15/20 • Suppression of vibrations of rotating systems by favourable grouping or relative arrangement of the moving members of the system or systems **[1, 2006.01]**

15/22 • Compensation of inertia forces **[1, 2006.01]**

15/24 • • of crankshaft systems by particular disposition of cranks, pistons, or the like **[1, 2006.01]**

15/26 • • of crankshaft systems using solid masses, other than the ordinary pistons, moving with the system **[1, 2006.01]**

15/28 • Counterweights; Attaching or mounting same (for roll-type closures E06B 9/62) **[1, 2006.01]**

15/30 • Flywheels (F16F 15/16 takes precedence; suppression of vibrations in rotating systems using elastic members or friction-damping members moving with the system F16F 15/12; rotary-body aspects in general F16C 13/00, F16C 15/00) **[1, 6, 2006.01]**

15/305 • • made of plastics, e.g. fibre reinforced plastics (FRP) **[6, 2006.01]**

15/31 • • characterised by means for varying the moment of inertia **[6, 2006.01]**

15/315 • • characterised by their supporting arrangement, e.g. mountings, cages, securing inertia member to shaft (F16F 15/31 takes precedence) **[6, 2006.01]**

15/32 • Correcting- or balancing-weights or equivalent means for balancing rotating bodies, e.g. vehicle wheels **[1, 2, 5, 2006.01]**

15/34 • • Fastening arrangements therefor **[5, 2006.01]**

15/36 • • operating automatically **[5, 2006.01]**