

## 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)

- 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 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 displaceable 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

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<b>1/00</b>	<b>Springs</b> (working with fluid F16F 5/00, F16F 9/00)	1/10	• • •	Spiral springs with turns lying substantially in plane surfaces
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 <b>[6]</b>	1/12	• • •	Attachments or mountings
		1/13	• • •	comprising inserts or spacers between the windings for changing the mechanical or physical characteristics of the spring <b>[6]</b>
1/04	• • Wound springs			
1/06	• • • with turns lying in cylindrical surfaces	1/14	• •	Torsion springs consisting of bars or tubes
1/08	• • • with turns lying in mainly conical surfaces	1/16	• • •	Attachments or mountings
		1/18	• •	Leaf springs

## F16F

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

### 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)

- 3/02 • with springs made of steel or of other material having low internal friction
- 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
- 3/07 • • combined with chambers filled with gas or liquid
- 3/08 • with springs made of a material having high internal friction, e.g. rubber
- 3/087 • • Units comprising several springs made of plastics or the like material (F16F 1/40 takes precedence) [6]

- 3/093 • • • the springs being of different materials, e.g. having different types of rubber [6]
- 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, e.g. being embedded in it [6]

### 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

### 6/00 Magnetic springs; Fluid magnetic springs

### 7/00 Vibration-dampers; Shock-absorbers (using fluid F16F 5/00, F16F 9/00; specific for rotary systems F16F 15/10)

- 7/01 • using friction between loose particles, e.g. sand [6]
- 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) [6]
- 7/04 • • in the direction of the axis of rotation
- 7/06 • • in a direction perpendicular or inclined to the axis of rotation
- 7/08 • with friction surfaces rectilinearly movable along each other (F16F 7/01 takes precedence) [6]
- 7/09 • • in dampers of the cylinder-and-piston type [6]
- 7/10 • using inertia effect
- 7/104 • • the inertia member being resiliently mounted [6]
- 7/108 • • • on plastics springs [6]
- 7/112 • • • on fluid springs [6]
- 7/116 • • • on metal springs [6]
- 7/12 • using plastic deformation of members
- 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; door-operating appliances with fluid braking systems E05F)

- 9/02 • using gas only
- 9/04 • • in a chamber with a flexible wall
- 9/05 • • • the flexible wall being of the rolling diaphragm type [5]
- 9/06 • using both gas and liquid
- 9/08 • • in a chamber with a flexible wall
- 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]
- 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]
- 9/092 • • • comprising a gas spring with a flexible wall provided between the tubes of a bitubular damper [6]
- 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]
- 9/10 • using liquid only; using a fluid of which the nature is immaterial
- 9/12 • • Devices with one or more rotary vanes turning in the fluid, any throttling effect being immaterial

- 9/14 • • Devices with one or more members, e.g. pistons, vanes, moving to and fro in chambers and using throttling effect
- 9/16 • • • involving only straight-line movement of the effective parts
- 9/18 • • • • with a closed cylinder and a piston separating two or more working spaces therein
- 9/19 • • • • • with a single cylinder
- 9/20 • • • • • with the piston-rod extending through both ends of the cylinder
- 9/22 • • • • • with one or more cylinders, each having a single working space closed by a piston or plunger
- 9/24 • • • • • with a single cylinder and a single 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
- 9/30 • with solid or semi-solid material, e.g. pasty masses, as damping medium
- 9/32 • Details
- 9/34 • • Special valve constructions (valves in general F16K); Shape or construction of throttling passages
- 9/342 • • • Throttling passages operating with metering pins
- 9/344 • • • Vortex flow passages [6]
- 9/346 • • • Throttling passages in the form of slots arranged in cylinder walls
- 9/348 • • • Throttling passages in the form of annular discs operating in opposite directions
- 9/36 • • Special sealings, including sealings or guides for piston-rods
- 9/38 • • Covers for protection or appearance
- 9/40 • • Arrangements for preventing froth
- 9/42 • • Cooling arrangements
- 9/43 • • Filling arrangements, e.g. for supply of gas
- 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) [5, 6]
- 9/46 • • • allowing control from a distance
- 9/48 • • Arrangements for providing different damping effects at different parts of the stroke (F16F 9/53, F16F 9/56 take precedence) [5, 6]
- 9/49 • • • Stops limiting fluid passage, e.g. hydraulic stops
- 9/50 • • Special means providing automatic damping adjustment (F16F 9/53, F16F 9/56 take precedence) [5, 6]
- 9/504 • • • Inertia-sensitive means [6]
- 9/508 • • • Means responsive to the velocity of movement of the piston [6]
- 9/512 • • • Means responsive to load action on the damper or fluid pressure in the damper [6]
- 9/516 • • • resulting in the damping effects during contraction being different from the damping effects during extension [6]
- 9/52 • • • in case of change of temperature (combined with external adjustment F16F 9/44)
- 9/53 • • Means for adjusting damping characteristics by varying fluid viscosity, e.g. electromagnetically [5]
- 9/54 • • Arrangements for attachment
- 9/56 • • Means for adjusting the length of, or for locking, the spring or damper, e.g. at the end of the stroke [6]
- 9/58 • • Stroke limiting stops, e.g. arranged on the piston rod outside the cylinder (F16F 9/49 takes precedence) [6]
- 11/00 **Vibration-dampers or shock-absorbers working with both friction and a damping fluid**
- 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)
- 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 [6]
- 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]
- 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]
- 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]
- 13/12 • • • • Single chamber dampers (F16F 13/14 takes precedence) [6]
- 13/14 • • • • Units of the bushing type [6]
- 13/16 • • • • • specially adapted for receiving axial loads [6]
- 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]
- 13/20 • • • characterised by comprising also a pneumatic spring (F16F 13/22 takes precedence) [6]
- 13/22 • • • characterised by comprising also a dynamic damper (dampers using inertia effect per se F16F 7/10) [6]
- 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]
- 13/26 • • characterised by adjusting or regulating devices responsive to exterior conditions [6]
- 13/28 • • • specially adapted for units of the bushing type (F16F 13/30 takes precedence) [6]
- 13/30 • • • comprising means for varying fluid viscosity, e.g. of magnetic or electrorheological fluids [6]
- 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)
- 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)
- 15/023 • • using fluid means [6]

## F16F

- 15/027 • • • comprising control arrangements [6]
- 15/03 • • using electromagnetic means (F16F 9/53 takes precedence) [5]
- 15/04 • • using elastic means (single elements or their attachment F16F 1/00-F16F 13/00) [2]
- 15/06 • • • with metal springs (with rubber springs also F16F 15/08)
- 15/067 • • • • using only wound springs [6]
- 15/073 • • • • using only leaf springs [6]
- 15/08 • • • with rubber springs
- 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)
- 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) [6]
- 15/121 • • • using springs as elastic members, e.g. metallic springs (F16F 15/131 takes precedence) [6]
- 15/123 • • • • Wound springs [6]
- 15/124 • • • • Plastics springs, e.g. made of rubber (F16F 15/123 takes precedence) [6]
- 15/126 • • • • • consisting of at least one annular element surrounding the axis of rotation [6]
- 15/127 • • • • using plastics springs combined with other types of springs [6]
- 15/129 • • • characterised by friction-damping means (F16F 15/131 takes precedence) [6]
- 15/131 • • • the rotating system comprising two or more gyratory masses [6]
- 15/133 • • • • using springs as elastic members, e.g. metallic springs [6]
- 15/134 • • • • • Wound springs [6]
- 15/136 • • • • • Plastics springs, e.g. made of rubber (F16F 15/134 takes precedence) [6]
- 15/137 • • • • • the elastic members consisting of two or more springs of different types [6]
- 15/139 • • • • characterised by friction-damping means [6]
- 15/14 • • using freely-swinging masses rotating with the system
- 15/16 • • using a fluid (devices connecting input and output members F16D)
- 15/167 • • • having an inertia member, e.g. ring [6]
- 15/173 • • • • provided within a closed housing [6]
- 15/18 • • using electric means (dynamo-electric devices H02K)
- 15/20 • Suppression of vibrations of rotating systems by favourable grouping or relative arrangement of the moving members of the system or systems
- 15/22 • Compensation of inertia forces
- 15/24 • • of crankshaft systems by particular disposition of cranks, pistons, or the like
- 15/26 • • of crankshaft systems using solid masses, other than the ordinary pistons, moving with the system
- 15/28 • Counterweights; Attaching or mounting same (for roll-type closures E06B 9/62)
- 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) [6]
- 15/305 • • made of plastics, e.g. fibre reinforced plastics (FRP) [6]
- 15/31 • • characterised by means for varying the moment of inertia [6]
- 15/315 • • characterised by their supporting arrangement, e.g. mountings, cages, securing inertia member to shaft (F16F 15/31 takes precedence) [6]
- 15/32 • Correcting- or balancing-weights or equivalent means for balancing rotating bodies, e.g. vehicle wheels [2, 5]
- 15/34 • • Fastening arrangements therefor [5]
- 15/36 • • operating automatically [5]