

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

- (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. [5]
- (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	Spring mattresses
A47C	27/00	
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.

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)	1/16	. . .	Attachments or mountings
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 [6]	1/18	. .	Leaf springs
		1/20	. . .	with layers, e.g. anti-friction layers, or with rollers between the leaves
1/04	. . Wound springs	1/22	. . .	with means for modifying the spring characteristic
1/06	. . . with turns lying in cylindrical surfaces	1/24	. . .	Lubrication; Covers, e.g. for retaining lubricant
1/08	. . . with turns lying in mainly conical surfaces	1/26	. . .	Attachments or mountings (B60G 11/10 takes precedence) [5]
1/10	. . . Spiral springs with turns lying substantially in plane surfaces	1/28	. . .	comprising cylindrical metal pins pivoted in close-fitting sleeves
1/12	. . . Attachments or mountings	1/30	. . .	comprising intermediate pieces made of rubber or similar elastic material
1/13	. . . comprising inserts or spacers between the windings for changing the mechanical or physical characteristics of the spring [6]	1/32	. .	Cup springs; Dished disc springs (diaphragms F16J 3/00)
1/14	. . Torsion springs consisting of bars or tubes			

- 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 coating 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]
- 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

F16F

- 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]