CPC  COOPERATIVE PATENT CLASSIFICATION

B  PERFORMING OPERATIONS; TRANSPORTING
(NOTES omitted)

TRANSPORTING

B60  VEHICLES IN GENERAL
(NOTE omitted)

B60G  VEHICLE SUSPENSION ARRANGEMENTS (air-cushion vehicles B60V; {cycle suspensions B62K 25/00})

NOTES

1. Attention is drawn to the explanatory note following the class title B60.
2. Indexing codes B60G 2200/00 - B60G 2800/00 are dedicated to particular aspects of suspension arrangements:
   • B60G 2200/00 refers to the type of suspension arrangement;
   • B60G 2202/00 refers to the suspension elements used (springs, dampers and actuators);
   • B60G 2204/00 refers to mounting features of suspension elements;
   • B60G 2206/00 refers to constructional and manufacturing details of suspension elements;
   • B60G 2300/00 refers to the type of vehicle;
   • B60G 2400/00 - B60G 2800/00 refer to the electronic control of suspension arrangements, whereby:
     • B60G 2400/00 refers to input parameters of the control;
     • B60G 2401/00 refers to types of sensors used;
     • B60G 2500/00 refers to the controlled action or device;
     • B60G 2600/00 refers to particular details of the control system;
     • B60G 2800/00 refers to the result to be achieved by the control action.
3. Groups B60G 2200/00 - B60G 2800/00 are to be used in multi-aspect classification, so that subject matter characterised by aspects covered by more than one of these groups, which is considered to represent information of interest for search, should be classified in a combination of at least one relevant "invention information" symbol in association with indexing codes from each of these groups.

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:
   B60G 23/00 covered by B60G 17/0165.
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  Suspensions with rigid connection between axle and frame
      1/02  . . with continuous axle
      1/04  . . with divided axle

3/00  Resilient suspensions for a single wheel (pivoted suspensions arms per se, attachment thereof to sprung part of the vehicle, buffer means for limiting movement of arms B60G 7/00; {rigid axle suspensions B60G 9/00;} characterised by arrangement, location or type of springs B60G 11/00)
      3/01  . . the wheel being mounted for sliding movement, e.g. in or on a vertical guide (camber maintaining means B60G 3/26)
      3/02  . . with a single pivoted arm
      3/04  . . . . the arm being essentially transverse to the longitudinal axis of the vehicle
      3/06  . . . . the arm being rigid
      3/08  . . . . the arm forming the axle housing
      3/10  . . . . the arm itself being resilient, e.g. leaf spring (B60G 7/003 takes precedence)

3/12  . . the arm being essentially parallel to the longitudinal axis of the vehicle
3/14  . . . . the arm being rigid
3/145 . . . . {the arm forming the axle housing}
3/16  . . . . the arm itself being resilient, e.g. leaf spring (B60G 7/003 takes precedence)
3/18  . . with two or more pivoted arms, e.g. parallelogram
3/185 . . . . {the arms being essentially parallel to the longitudinal axis of the vehicle}
3/20  . . all arms being rigid
3/202 . . . . {having one longitudinal arm and two parallel transversal arms, e.g. dual-link type strut suspension}
3/205 . . . . {with the pivotal point of the longitudinal arm being on the vertical plane defined by the wheel rotation axis and the wheel ground contact point}
3/207 . . . . {the arms being essentially parallel to the longitudinal axis of the vehicle}
3/22  . . a rigid arm forming the axle housing
3/225 . . . . {the arm being of the trailing wishbone type}
3/24 . . . a rigid arm being formed by the live axle

7/04 . . . Buffer means for limiting movement of arms

3/26 . . . Means for maintaining substantially-constant wheel camber during suspension movement

9/00 Resilient suspensions of a rigid axle or axle housing for two or more wheels

3/265 . . . [with a strut cylinder contributing to the suspension geometry by being linked to the wheel support via an articulation]

9/003 . . . [the axle being rigidly connected to a trailing guiding device]

3/28 . . . at least one of the arms itself being resilient, e.g. leaf spring

9/006 . . . [the axle being connected to two trailing arms with only one of them being rigidly connected to the axle]

3/285 . . . [the arm being essentially parallel to the longitudinal axis of the vehicle]

9/02 . . . the axle or housing being pivotally mounted on the vehicle, e.g. the pivotal axis being parallel to the longitudinal axis of the vehicle

5/00 Resilient suspensions for a set of tandem wheels or axles having interrelated movements

9/025 . . . [using linkages for the suspension of the axle allowing its lateral swinging displacement]

5/005 . . . [the wheels being fixed on a non-pivotal structure, e.g. a sliding mount]

9/027 . . . [the axle having either a triangular, a "T" or "U" shape and being directly articulated with the chassis only by its middle apex, e.g. De Dion suspension]

5/01 . . . the set being characterised by having more than two successive axles

9/04 . . . the axle or housing not being pivotally mounted on the vehicle

5/02 . . . mounted on a single pivoted arm, e.g. the arm being rigid

11/00 Resilient suspensions characterised by arrangement, location or kind of springs

5/025 . . . [the arm being transverse to the longitudinal axis of the vehicle]

11/003 . . . [Lubrication devices for springs and dampers (vehicle lubrication devices in general B60R 17/00; for leaf springs in general F16F 1/24)]

5/03 . . . the arm itself being resilient, e.g. a leafspring

11/006 . . . [Centrally located spring units, e.g. all wheels being connected to a common spring unit (B60G 5/00, B60G 17/003 take precedence)]

5/04 . . . with two or more pivoted arms, the movements of which are resiliently interrelated, e.g. the arms being rigid

11/02 . . . having leaf springs only

5/043 . . . [the arms being transverse to the longitudinal axis of the vehicle]

11/025 . . . [repairing devices for leaf springs]

5/047 . . . at least one arm being resilient, e.g. a leafspring

11/04 . . . [reparing devices for leaf springs]

5/053 . . . a leafspring being used as equilibration unit between two axle-supporting units

11/044 . . . arranged substantially parallel to the longitudinal axis of the vehicle

5/06 . . . the arms turning on a common pivot, e.g. being rigid

11/06 . . . arranged obliquely to the longitudinal axis of the vehicle

5/065 . . . [at least one arm being resilient]

11/08 . . . arranged substantially transverse to the longitudinal axis of the vehicle

7/00 Pivoted suspension arms; Accessories thereof

11/10 . . . characterised by means specially adapted for attaching the spring to axle or sprung part of the vehicle

(means for maintaining substantially constant wheel camber during suspension movement B60G 3/26; articulations for wheels B60G 5/00; leaf spring attaching means B60G 11/10, B60G 11/12; trailing arm twist beam axle attaching means B60G 21/052; articulations in general F16C)

7/001 . . . [Suspension arms, e.g. constructional features (B60G 7/006 takes precedence)]

11/107 . . . Sliding or rolling mountings

7/003 . . . [of adjustable length]

11/113 . . . Mountings on the axle (B60G 11/107 takes precedence)

7/005 . . . [Ball joints (B60G 7/006 takes precedence; for steering linkage B62D 7/16; ball joints per se F16C 11/06)]

11/12 . . . Links, pins, or bushes

7/006 . . . [Attaching arms to sprung or unsprung part of vehicle, characterised by comprising attachment means controlled by an external actuator, e.g. a fluid or electrical motor (B62D 7/146 takes precedence)]

11/125 . . . [Multiple-eye arrangements]

7/008 . . . [Attaching arms to unsprung part of vehicle (B60G 7/005, B60G 7/006 take precedence)]

11/14 . . . having helical, spiral or coil springs only

7/02 . . . Attaching arms to sprung part of vehicle

11/15 . . . Coil springs resisting deflection by winding up

(B60G 7/003 takes precedence)

(B60G 5/005 takes precedence)

(B60G 7/006 takes precedence)

(B60G 5/00 takes precedence)

(B60G 7/003 takes precedence)

(B60G 5/053 takes precedence)

(B60G 7/006 takes precedence)

(B60G 5/006 takes precedence)

(B60G 7/006 takes precedence)

(B60G 5/05 takes precedence)

(B60G 7/006 takes precedence)

(B60G 5/05 takes precedence)

(B60G 11/006 takes precedence)
characterised by means specially adapted for attaching the spring to axle or sprung part of the vehicle

being torsion-bar springs only ([B60G 11/006 takes precedence; having rubber springs of the torsional-energy-absorption type B60G 11/23]

NOTE
B60G 11/184 takes precedence over B60G 11/181 - B60G 11/183

... (arranged in a plane parallel to the longitudinal axis of the vehicle)

... (arranged in a plane oblique to the longitudinal axis of the vehicle)

... (arranged in a plane transverse to the longitudinal axis of the vehicle)

... (the torsion-bar consisting of a bundle of torsion elements)

... [the elements being rods]

... {of hexagonal cross-section}

... [the elements being leaf-springs loaded by twisting]

... [the elements being cables]

... [the torsion spring consisting of a tube with a slit]

... characterised by means specially adapted for attaching the spring to axle or sprung part of the vehicle

... having rubber springs only ([B60G 11/006 takes precedence])

... [Neidhart type rubber springs]

... of the torsional-energy-absorption type

... characterised by means specially adapted for attaching the spring to axle or sprung part of the vehicle

... having fluid springs only, e.g. hydropneumatic springs ([B60G 11/006, B60G 15/12 take precedence]

... [hydraulic springs]

... wherein the fluid is a gas

... characterised by means specially adapted for attaching the spring to axle or sprung part of the vehicle

... having fluid accumulator therefor, e.g. accumulator arranged in vehicle frame ([(dampers accumulating utilisable energy B60G 13/14)]

... having springs of different kinds ([B60G 11/006 takes precedence])

... including leaf springs

... and also helical, spiral or coil springs

... and also rubber springs

... the rubber springs being attached to the axle

... the rubber springs being attached to sprung part of the vehicle

... and also torsion-bar springs

... and also fluid springs

... [with a flexible wall]

... not including leaf springs

... having helical, spiral or coil springs, and also torsion-bar springs

... having helical, spiral or coil springs, and also rubber springs

... with rubber springs arranged within helical, spiral or coil springs

... having helical, spiral or coil springs, and also fluid springs

... arranged coaxially

... having both rubber springs and torsion-bar springs

... having both rubber springs and fluid springs

... having both torsion-bar springs and fluid springs

13/00 Resilient suspensions characterised by arrangement, location or type of vibration dampers (adjusting damping effect B60G 17/06; vibration dampers per se F16F)

13/001 ... {Arrangements for attachment of dampers (mounting arrangements of combined spring and damper units B60G 15/00; mountings of fluid dampers in general F16F 9/54)}

13/003 ... [characterised by the mounting on the vehicle body or chassis of the damper unit]

13/005 ... [characterised by the mounting on the axle or suspension arm of the damper unit]

13/006 ... [on the stub axle]

13/008 ... [involving use of an auxiliary cylinder (B60G 13/006 takes precedence)]

13/02 ... having dampers dissipating energy, e.g. frictionally

13/04 ... mechanically, e.g. having frictionally-engaging springs as damping elements

13/06 ... of fluid type

13/08 ... hydraulic

13/10 ... pneumatic

13/12 ... quasi-fluid, i.e. having powdered medium

13/14 ... having dampers accumulating utilisable energy, e.g. compressing air {fluid springs with an accumulator B60G 11/30)

13/16 ... having dynamic absorbers as main damping means, i.e. spring-mass system vibrating out of phase

13/18 ... combined with energy-absorbing means

15/00 Resilient suspensions characterised by arrangement, location or type of combined spring and vibration damper, e.g. telescopic type (combined spring and vibration-dampers per se F16F)

15/02 ... having mechanical spring

15/04 ... and mechanical damper [or dynamic damper]

15/06 ... and fluid damper

15/061 ... [with a coil spring being mounted inside the damper]

15/062 ... [the spring being arranged around the damper (B60G 15/061, B60G 15/067, B60G 15/07 take precedence)]

15/063 ... [characterised by the mounting of the spring on the damper (B60G 15/065, B60G 15/066 take precedence)]

15/065 ... [characterised by the use of a combination of springs]

15/066 ... [the spring being different from a coil spring (B60G 15/062 takes precedence)]

15/067 ... [characterised by the mounting on the vehicle body or chassis of the spring and damper unit]

15/068 ... [specially adapted for MacPherson strut-type suspension]
15/07 . . . the damper being connected to the stub axle and the spring being arranged around the damper (B60G 15/068 takes precedence)
15/08 . having fluid spring
15/10 . . . and mechanical damper (or dynamic damper)
15/12 . . . and fluid damper
15/14 . . . the damper being connected to the stub axle and the spring being arranged around the damper

17/00 Resilient suspensions having means for adjusting the spring or vibration-damper characteristics, for regulating the distance between a supporting surface and a sprung part of vehicle or for locking suspension during use to meet varying vehicular or surface conditions, e.g. due to speed or load (levelling or stabilising systems for tippers B60P 1/045)
17/002 . . . [by temperature regulation of the suspension unit, e.g. heat operated systems]
17/005 . Suspension locking arrangements (for retractable wheels B62D 61/12)
17/015 . . . the regulating means comprising electric or electronic elements (B60G 17/002, B60G 17/005 take precedence)
17/0152 . . . [characterised by the action on a particular type of suspension unit (B60G 17/01941 takes precedence)]
17/0155 . . . [pneumatic unit]
17/0157 . . . [non-fluid unit, e.g. electric motor]
17/016 . . . characterised by their responsiveness, when the vehicle is travelling, to specific motion, a specific condition, or driver input (B60G 17/017 takes precedence)
17/0161 . . . [mainly during straight-line motion (B60G 17/0164 takes precedence)]
17/0162 . . . [mainly during a motion involving steering operation, e.g. cornering, overtaking (B60G 17/0164 takes precedence)]
17/0163 . . . [the control involving steering geometry, e.g. four-wheel steering]
17/0164 . . . [mainly during accelerating or braking]
17/0165 . . . to an external condition, e.g. rough road surface, side wind
17/017 . . . characterised by their use when the vehicle is stationary, e.g. during loading, engine start-up or switch-off
17/018 . . . characterised by the use of a specific signal treatment or control method
17/0182 . . . [involving parameter estimation, e.g. observer, Kalman filter]
17/0185 . . . for failure detection
17/019 . . . characterised by the type of sensor or the arrangement thereof (B60G 17/01941 takes precedence)
17/01908 . . . [Acceleration or inclination sensors (characterised by the use of gyroscopes B60G 21/08)]
17/01916 . . . [Mercury-switch type devices]
17/01925 . . . [Pendulum-type devices]
17/01933 . . . [Velocity, e.g. relative velocity-displacement sensors]
17/01941 . . . [characterised by the use of piezo-electric elements, e.g. sensors or actuators]
17/0195 . . . characterised by the regulation being combined with other vehicle control systems (conjoint control of vehicle sub-units including control of suspension systems B60W 10/22)
17/02 . Spring characteristics, e.g. mechanical springs and mechanical adjusting means (B60G 17/005, B60G 17/015 take precedence)
17/021 . . . [the mechanical spring being a coil spring (B60G 17/0272 takes precedence)]
17/023 . . . [the mechanical spring being a leaf spring (B60G 17/0275 takes precedence)]
17/025 . . . [the mechanical spring being a torsion spring (B60G 17/0277, B60G 21/0553 take precedence)]
17/027 . Mechanical springs regulated by fluid means (B60G 17/033 takes precedence)
17/0272 . . . [the mechanical spring being a coil spring]
17/0275 . . . [the mechanical spring being a leaf spring]
17/0277 . . . [the mechanical spring being a torsion spring (B60G 21/0553 takes precedence)]
17/033 . . . characterised by regulating means acting on more than one spring
17/04 . . . fluid spring characteristics
17/0408 . . . [details, e.g. antifreeze for suspension fluid, pumps, retarding means per se]
17/0416 . . . [regulated by varying the resiliency of hydropneumatic suspensions (B60G 17/048 takes precedence)]
17/0424 . . . [by varying the air pressure of the accumulator]
17/0432 . . . [by varying the number of accumulators connected to the hydraulic cylinder (B60G 17/0424 takes precedence)]
17/044 . . . Self-pumping fluid springs (pumps for liquids F04)
17/048 . . . with the regulating means inside the fluid springs (B60G 17/044 takes precedence)
17/0485 . . . [the springs being pneumatic springs with a flexible wall, e.g. with levelling valves]
17/052 . . . Pneumatic spring characteristics (B60G 17/048 takes precedence; valves per se F16K)
17/0521 . . . [the spring having a flexible wall]
17/0523 . . . [Regulating distributors or valves for pneumatic springs]
17/0525 . . . [Height adjusting or levelling valves]
17/0526 . . . [Distributor units, e.g. for retractable wheels (vehicles with retractable wheels per se B62D 61/12)]
17/0528 . . . [Pressure regulating or air filling valves]
17/056 . . . Regulating distributors or valves (for hydropneumatic systems B60G 17/044 - B60G 17/048; B60G 17/0416) take precedence; Fluid interconnection systems to control vehicle inclination (B60G 21/06, B60G 21/10); valves per se F16K)
17/0565 . . . [Height adjusting valves]
17/06 . Characteristics of dampers (e.g. mechanical dampers) (B60G 17/015 takes precedence)
17/08 . Characteristics of fluid dampers (adjusting fluid dampers in general F16F 9/44 - F16F 9/53)
21/00 Interconnection systems for two or more resiliently-suspended wheels, e.g. for stabilising a vehicle body with respect to acceleration, deceleration or centrifugal forces (B60G 17/033 takes precedence; \{ levelling or stabilising systems for tippers B60P 10/043 \}; steering deflectable wheels combined with means for inwardly inclining the vehicle body on bends B62D 9/02)

21/002 . . . [longitudinally]
21/005 . . . [transversally]
21/007 . . . [means for adjusting the wheel inclination]
21/02 . . . permanently interconnected
21/023 . . . [longitudinally]
21/026 . . . [transversally]
21/04 . . . mechanically
21/045 . . . between wheels on different axles on the same side of the vehicle, i.e. the left or the right side
21/05 . . . between wheels on the same axle but on different sides of the vehicle, i.e. the left and right wheel suspensions being interconnected
21/051 . . . . . . . . . . {Trailing arm twist beam axles}
21/052 . . . . . . . . . . {Mounting means therefor}
21/053 . . . . . . . . . . {adjustable}
21/055 . . . . . . . . . . Stabiliser bars
21/0551 . . . . . . . . . . {Mounting means therefor}
21/0553 . . . . . . . . . . {adjustable}
21/0555 . . . . . . . . . . . . . . . [including an actuator inducing vehicle roll] 2200/40
21/0556 . . . . . . . . . . . . . . . {including a releasable coupling (B60G 21/0555 takes precedence)}
21/0558 . . . . . . . . . . . . . . . . . . . . . . [including means varying the stiffness of the stabiliser (B60G 21/0556 takes precedence)]
21/06 . . . fluid
21/067 . . . between wheels on different axles on the same side of the vehicle, i.e. the left or the right side
21/073 . . . between wheels on the same axle but on different sides of the vehicle, i.e. the left and right wheel suspensions being interconnected
21/08 . . . characterised by use of gyroscopes (gyroscopes for stabilising vehicle bodies without controlling suspension arrangements B62D 37/06)
21/10 . . . not permanently interconnected, e.g. operative only on acceleration, only on deceleration or only at off-straight position of steering
21/103 . . . . . . . . . . . . . . . . . . . . . . [longitudinally]
21/106 . . . . . . . . . . . . . . . . . . . . . . [transversally]

99/00 Subject matter not provided for in other groups of this subclass

99/002 . . . [Suspension details of the suspension of the vehicle body on the vehicle chassis]
99/004 . . . [Other suspension arrangements with rubber springs]
99/006 . . . [Other suspension arrangements with metallic springs]
99/008 . . . [Other suspension arrangements with fluid springs]

2200/00 Indexing codes relating to suspension types

2200/10 . . . Independent suspensions
2200/13 . . . with longitudinal arms only
2200/132 . . . with a single trailing arm
2200/1322 . . . with a wishbone or triangular arm
2200/1324 . . . with a resilient trailing arm
2200/14 . . . with lateral arms
2200/141 . . . with one trailing arm and one lateral arm only
2200/142 . . . with a single lateral arm, e.g. MacPherson type
2200/1422 . . . the lateral arm being resilient
2200/1424 . . . the lateral arm having an L-shape
2200/143 . . . with lateral arms crossing each other, i.e. X formation as seen along the longitudinal axis
2200/144 . . . with two lateral arms forming a parallelogram
2200/1442 . . . including longitudinal rods
2200/154 . . . the lateral arm having an L-shape
2200/156 . . . wishbone-type arm formed by two links defining a virtual apex
2200/17 . . . with a strut contributing to the suspension geometry by being articulated onto the wheel support
2200/18 . . . Multilink suspensions, e.g. elastokinematic arrangements
2200/182 . . . with one longitudinal arm or rod and lateral rods
2200/184 . . . Assymetric arrangements
2200/20 . . . Semi-rigid axle suspensions
2200/21 . . . Trailing arms connected by a torsional beam, i.e. twist-beam axles
2200/22 . . . Trailing arms connected by a straight torsion bar
2200/23 . . . Trailing arms connected by a U-shaped torsion bar
2200/24 . . . Interconnected split axles
2200/30 . . . Rigid axle suspensions
2200/31 . . . with two trailing arms rigidly connected to the axle
2200/312 . . . with one of the two trailing arms being rigidly connected to the axle
2200/314 . . . with longitudinally arranged arms articulated on the axle
2200/316 . . . at least one of the arms having an A or V shape
2200/318 . . . two or more axles being mounted on a longitudinal rocking or walking beam
2200/32 . . . pivoted
2200/322 . . . with a single pivot point and a straight axle
2200/324 . . . with a single pivot point and a triangular “T” or “U”-shaped axle, e.g. De Dion arrangement
2200/326 . . . with two laterally spaced pivots, e.g. trailing frame
2200/34 . . . Stabilising mechanisms, e.g. for lateral stability
2200/341 . . . Panhard rod
2200/3415 . . . Scott-Russel linkage
2200/342 . . . Watt linkage
2200/343 . . . with an axle suspended by two pivoted rods in “V”-arrangement, the rods being coupled at its apex
2200/344 . . . with an axle suspended by two pivoted rods in an inverted “V”-arrangement, the rods being coupled at its apex
2200/345 . . . with an axle suspended by two pivoted rods in “X”-arrangement
2200/346 . . . with an axle suspended by two laterally displaced rods having an imaginary point of intersection above the wheel axis
2200/347 . . . with an axle suspended by two laterally displaced rods having an imaginary point of intersection below the wheel axis
2200/40 . . . Indexing codes relating to the wheels in the suspensions
B60G

2202/00 Indexing codes relating to the type of spring, damper or actuator

2202/10 . Type of spring
2202/11 . Leaf spring
2202/112 . longitudinally arranged
2202/114 . transversally arranged
2202/116 . having a "C" form loaded only at its ends transversally to its central axis
2202/117 . having a "C" form loaded parallel to its central axis
2202/12 . Wound spring
2202/122 . subjected to tension
2202/13 . Torsion spring
2202/132 . comprising a longitudinal torsion bar and/or tube
2202/134 . comprising a transversal torsion bar and/or tube
2202/135 . Stabiliser bar and/or tube
2202/1351 . comprising at least two stabiliser bars parallel to each other
2202/136 . Twist-beam type arrangement
2202/1362 . including a second torsional element, e.g. second beam, stabiliser bar or tube
2202/14 . Plastic spring, e.g. rubber
2202/141 . subjected to tension
2202/142 . subjected to shear, e.g. Neidhart type
2202/1422 . Axial
2202/1424 . Torsional
2202/143 . subjected to compression
2202/144 . of rotary type
2202/15 . Fluid spring
2202/152 . Pneumatic spring
2202/1522 . of rotary type
2202/1524 . with two air springs per wheel, arranged before and after the wheel axis
2202/154 . with an accumulator
2202/156 . Magnetic spring
2202/20 . Type of damper
2202/21 . with two dampers per wheel, arranged before and after the wheel axis
2202/22 . Rotary Damper
2202/23 . Friction Damper
2202/24 . Fluid damper
2202/242 . Pneumatic damper
2202/25 . Dynamic damper
2202/30 . Spring/Damper and/or actuator Units
2202/31 . with the spring arranged around the damper, e.g. MacPherson strut
2202/312 . The spring being a wound spring
2202/314 . The spring being a pneumatic spring
2202/32 . The spring being in series with the damper and/or actuator
2202/322 . the damper being controllable
2202/40 . Type of actuator
2202/41 . Fluid actuator
2202/412 . Pneumatic actuator
2202/413 . Hydraulic actuator
2202/414 . using electrohydraulic valves
2202/415 . using other types of valves, e.g. mechanically operated valves
2202/416 . using a pump, e.g. in the line connecting the lower chamber to the upper chamber of the actuator
2202/42 . Electric actuator
2202/422 . Linear motor
2202/424 . electrostrictive materials, e.g. piezoelectric actuator
2202/43 . Mechanical actuator
2202/432 . Spring motor
2202/44 . Axial actuator, e.g. telescopic
2202/441 . where axial movement is translated to rotation of the connected end part
2202/442 . Rotary actuator
2202/45 . Other types, e.g. external jets for stability with particular characteristics
2202/49 . Other type, e.g. external jets for stability

2204/00 Indexing codes related to suspensions per se or to auxiliary parts

2204/10 . Mounting of suspension elements
2204/11 . Mounting of sensors thereon
2204/111 . on pneumatic springs
2204/112 . on dampers, e.g. fluid dampers
2204/113 . Tyre related sensors
2204/114 . Steering column mounted sensors
2204/115 . Wheel hub bearing sensors
2204/116 . Sensors coupled to the suspension arm
2204/1162 . directly mounted on the suspension arm
2204/12 . Mounting of springs or dampers
2204/121 . Mounting of leaf springs
2204/122 . Mounting of torsion springs
2204/1222 . Middle mounts of stabiliser on vehicle body or chassis
2204/1224 . End mounts of stabiliser on wheel suspension
2204/1226 . on the trailing arms of a twist beam type arrangement
2204/124 . Mounting of coil springs
2204/1242 . on a damper, e.g. MacPerson strut
2204/12422 . anchoring the end coils on the spring support plate
2204/1244 . on a suspension arm
2204/1246 . on twist beam axles
2204/125 . Mounting of rubber type springs
2204/126 . Mounting of pneumatic springs
2204/1262 . on a damper
2204/127 . with the mounting of springs or dampers moving so that the direction of the related force vector can be changed, thus contributing to a variation of the loading of the wheel
2204/128 . Damper mount on vehicle body or chassis
2204/129 . Damper mount on wheel suspension or knuckle
2204/13 . with the spring, i.e. coil spring, or damper horizontally mounted
2204/1302 . inside the vehicle frame
2204/14 . . Mounting of suspension arms
2204/143 . . on the vehicle body or chassis
2204/1431 . . . of an L-shaped arm
2204/1432 . . . by vertical bolts or studs
2204/1434 . . . in twist-beam axles arrangement
2204/147 . . . on the vehicle engine body
2204/148 . . . on the unsprung part of the vehicle, e.g. wheel knuckle or rigid axle
2204/1482 . . . on rigid axle by elastic mount
2204/1484 . . . on an intermediate upright strut upon which the stub axle is pivoted
2204/149 . . . Mounting of rigid axle on wheel knuckle
2204/15 . . . Mounting of subframes
2204/16 . . . Mounting of vehicle body on chassis
2204/162 . . . Cabins, e.g. for trucks, tractors
2204/17 . . . Mounting of bogies, e.g. for trailers
2204/18 . . . Mounting of vehicle engines
2204/182 . . . Electric motor on wheel support
2204/19 . . . Mounting of transmission differential
2204/20 . . . Mounting of accessories, e.g. pump, compressor
2204/201 . . . of fluid lines
2204/202 . . . of cables
2204/2022 . . . using a suspension element (e.g. link, damper or spring) as part of the electrical circuitry
2204/22 . . . Linking of trailers to trucks, e.g. truck-trailer connections
2204/30 . . . In-wheel mountings
2204/40 . . . Auxiliary suspension parts: Adjustment of suspensions
2204/41 . . . Elastic mounts, e.g. bushings
2204/4102 . . . having a pin or stud extending perpendicularly to the axis of the elastic mount
2204/4103 . . . having an eccentrically located inner sleeve
2204/4104 . . . Bushings having modified rigidity in particular directions
2204/41042 . . . by using internal cam surfaces
2204/41043 . . . formed by a U-shaped external bracket
2204/41044 . . . in a shell for being loaded mainly in axial direction, e.g. piston rod mounts, longitudinal push-pull rod mounts
2204/41046 . . . having the axis of an inner sleeve or pin inclined to the axis of the bush
2204/4106 . . . Elastokinematic mounts
2204/41062 . . . hydromounts; interconnected mounts
2204/4108 . . . Resilient element being enclosed and or pressed in a solid container
2204/414 . . . Cardan joints
2204/416 . . . Ball or spherical joints
2204/418 . . . Bearings, e.g. ball or roller bearings
2204/419 . . . Gears
2204/4191 . . . Planetary or epicyclic gears
2204/4192 . . . rack and pinion
2204/4193 . . . worm gears
2204/42 . . . Joints with cam surfaces
2204/421 . . . Pivoted lever mechanisms for mounting suspension elements, e.g. Watt linkage
2204/422 . . . Links for mounting suspension elements
2204/4222 . . . for movement on predefined locus of, e.g. the wheel center
2204/423 . . . Rails, tubes, or the like, for guiding the movement of suspension elements
2204/4232 . . . Sliding mounts
2204/424 . . . Mechanisms for force adjustment, e.g. constant force mechanisms
2204/43 . . . Fittings, brackets or knuckles
2204/4302 . . . for fixing suspension arm on the vehicle body or chassis
2204/4304 . . . Bracket for lower cylinder mount of McPherson strut
2204/4305 . . . Bracket for mounting of hydraulic lines on a damper cylinder
2204/4306 . . . Bracket or knuckle for rigid axles, e.g. for clamping
2204/43065 . . . U-shaped bolts crossing each other
2204/4307 . . . Bracket or knuckle for torsional springs
2204/4308 . . . Protecting guards, e.g. for rigid axle damage protection
2204/44 . . . Centering or positioning means
2204/4402 . . . Spacers or shims
2204/4404 . . . Retainers for holding a fixing element, e.g. bushing, nut, bolt etc., until it is tightly fixed in position
2204/45 . . . Stops limiting travel
2204/4502 . . . using resilient buffer
2204/45021 . . . for limiting upper mount movement of a McPherson strut
2204/4504 . . . using cable or band to prevent extension
2204/46 . . . Means for locking the suspension
2204/4602 . . . Locking of a McPerson type strut upper mount on the vehicle body
2204/4604 . . . mechanically, e.g. using a hook as anticreep mechanism
2204/4605 . . . hydraulically, e.g. using a hook as anticreep mechanism
2204/47 . . . Means for retracting the suspension
2204/4702 . . . pneumatically
2204/48 . . . Adjustable during maintenance
2204/62 . . . Adjustable continuously, e.g. during driving
2204/80 . . . Interactive suspensions; arrangement affecting more than one suspension unit
2204/81 . . . front and rear unit
2204/8102 . . . diagonally arranged
2204/82 . . . left and right unit on same axle
2204/83 . . . Type of interconnection
2204/8302 . . . Mechanical
2204/83022 . . . using cables, wires, belts or chains
2204/8304 . . . using a fluid
2204/8306 . . . Permanent; Continuous

2206/00 Indexing codes related to the manufacturing of suspensions: constructional features, the materials used, procedures or tools
2206/01 . . . Constructional features of suspension elements, e.g. arms, dampers, springs
2206/011 . . . Modular constructions
2206/0112 . . . Bogies for heavy vehicles
2206/0114 . . . Independent suspensions on subframes
2206/0116 . . . Integrated distribution control units with valves, accumulators, PCB’s or the like
2206/012 . . . Hollow or tubular elements
2206/0122 . . . having a U profile with plate closing the profile in the total or partial length of the element
2206/013 . . . with embedded inserts for material reinforcement
2206/014 . . . with reinforcing nerves or branches
2206/016 . . . allowing controlled deformation during collision
Materials used in suspensions

Subframe construction

Attachments or knuckles, e.g. steering knuckles, spindle

Constructional features of wheel supports

Constructional features of dampers and/or springs

Constructional features of rigid axles

Twist beam type axles

Constructional features of semi-rigid axles, e.g. twist beam type axles

Constructional features of arms

the arm having an H or X-shape

the arm having L-shape

the arm having T-shape

the arm having triangular or Y-shape, e.g. wishbone

with two attachment points on the sprung part of the vehicle

the arm forming a U-shaped recess for fitting a bush

The recess being integrally or seamlessly formed

the arm being resilient

the arm having a U profile and/or made of a plate

with more than two attachment points on the sprung part of the vehicle

with detachable cross beam and/or torsion stabiliser bar/tube

with a radially deformed tube as a cross member

with outwardly bent trailing arms to increase the width of the support or wheelbase

Constructional features of rigid axles

Straight axle

Cranked axle

Hollow cross section

Constructional features of dampers and/or springs

Dampers

Springs

Accumulators for hydropneumatic springs

with a flexible separating wall; Membrane construction

Plunger or top retainer construction for bellows or rolling lobe type air springs

Coil springs having a particular shape, e.g. curved axis, pig-tail end coils

Stabiliser bars or tubes

Leaf springs

Constructional features of wheel supports or knuckles, e.g. steering knuckles, spindle attachments

Subframe construction

Hanger bracket

Single transverse beam

with two parallel beams connected by cross members

Flexible constructions

Complex constructions

Materials used in suspensions

Light weight materials

Fiber-reinforced plastics [FRP]

Aluminium alloys

Magnesium alloys

Thermoplastics

Polyester elastomer

Polyamid elastomer

Soft nylon

Porous materials, ceramics, e.g. as filling material

Steel

Plates

Wires, bars or the like

Rubber, Elastomers

Manufacturing procedures

Shaping

by casting

by injection moulding

by stamping

by forging

by folding or bending

involving heating to relieve internal stresses

by drawing

by extrusion

by thermal treatment, e.g. curing hardening, vulcanisation

to relieve internal stresses, e.g. during folding or bending

by hydroforming

by twisting

by rolling

by cutting

by machining

by thermal spraying of molten material

Joining

by welding

Pressure welding

Friction or heat welding

Magnetic pulse welding (welding by magnetic pulse in general B23K 20/06)

by conical or compressed rubber clamping inserts as joining means

by riveting

by screwing

by hemming or seaming, e.g. by folding of the rim

by deformation

by press-fitting

by gluing

Punching

Hardening

Annealing

Quenching

Shot-peening

Filament winding

Maintenance

Assembly procedures

using a modification kit

Tools or equipment used for assembling

Coil spring compressor

Tools used for adjustments
2400/05144  . . . Wheel toe
2400/05146  . . . Wheel caster
2400/0516  . . . Angular position of a suspension element
2400/05162  . . . the element being a suspension arm
2400/052  . . . Angular rate
2400/0521  . . . Roll rate
2400/0522  . . . Pitch rate
2400/0523  . . . Yaw rate
2400/053  . . . Angular acceleration
2400/0531  . . . Roll acceleration
2400/0532  . . . Pitch acceleration
2400/0533  . . . Yaw acceleration
2400/10  . . . Acceleration; Deceleration
2400/102  . . . vertical
2400/104  . . . lateral or transversal with regard to vehicle
2400/1042  . . . using at least two sensors
2400/106  . . . longitudinal with regard to vehicle, e.g. braking
2400/1062  . . . using at least two sensors
2400/20  . . . Speed
2400/202  . . . Piston speed; Relative velocity between vehicle body and wheel
2400/204  . . . Vehicle speed
2400/2042  . . . Lateral speed
2400/206  . . . Body oscillation speed; Body vibration frequency
2400/208  . . . of wheel rotation
2400/25  . . . Stroke; Height; Displacement
2400/252  . . . vertical
2400/256  . . . horizontal
2400/257  . . . transversal with regard to vehicle
2400/258  . . . longitudinal with regard to vehicle
2400/30  . . . Propulsion unit conditions
2400/302  . . . Selected gear ratio; Transmission function
2400/304  . . . neutral position
2400/306  . . . overdrive
2400/31  . . . Clutch condition
2400/32  . . . Torque on propulsion shaft
2400/33  . . . Throttle position
2400/34  . . . Accelerator pedal position
2400/35  . . . Position of fuel or air injector
2400/36  . . . Functioning of turbocharger
2400/37  . . . Brake pad or disc friction
2400/38  . . . Speed of engine rotation
2400/382  . . . Ignition switch
2400/39  . . . Brake pedal position
2400/40  . . . Steering conditions
2400/41  . . . Steering angle
2400/412  . . . of steering wheel or column
2400/4122  . . . Neutral position detection
2400/42  . . . Steering torque
2400/44  . . . Steering speed
2400/46  . . . Steering frequency
2400/47  . . . Rear wheel steering
2400/50  . . . Pressure
2400/51  . . . in suspension unit
2400/512  . . . in spring
2400/5122  . . . Fluid spring
2400/51222  . . . Pneumatic
2400/518  . . . in damper
2400/5182  . . . Fluid damper
2400/52  . . . in tyre
2400/60  . . . Load

Indexing codes relating to detected, measured or calculated conditions or factors

2400/05  . . . Attitude
2400/051  . . . Angle
2400/0511  . . . Roll angle
2400/0512  . . . Pitch angle
2400/0513  . . . Yaw angle
2400/0514  . . . Wheel angle detection
2400/05142  . . . Wheel camber

2300/00  . . . Indexing codes relating to the type of vehicle

2300/02  . . . Trucks; Load vehicles
2300/022  . . . Fork lift trucks, Clark
2300/024  . . . Light trucks
2300/026  . . . Heavy duty trucks
2300/0262  . . . Multi-axle trucks
2300/03  . . . Silo or fluid transporting vehicles
2300/04  . . . Trailers
2300/042  . . . Semi-trailers
2300/044  . . . Truck-trailer connections
2300/06  . . . Cranes
2300/07  . . . Off-road vehicles
2300/08  . . . Agricultural vehicles
2300/082  . . . Tractors
2300/083  . . . Boom carrying vehicles, e.g. for crop spraying
2300/084  . . . Ridable lawn mowers
2300/09  . . . Construction vehicles, e.g. graders, excavators
2300/10  . . . Railway vehicles
2300/102  . . . having track following mechanism for lateral stability
2300/12  . . . Cycles; Motorcycles
2300/122  . . . Trikes
2300/124  . . . Quads
2300/13  . . . Small sized city motor vehicles
2300/14  . . . Buses
2300/16  . . . Aeroplanes
2300/18  . . . Helicopters
2300/20  . . . Toys
2300/22  . . . Perambulators
2300/24  . . . Wheelchairs
2300/26  . . . Carts
2300/27  . . . Racing vehicles, e.g. F1
2300/28  . . . Amphibious vehicles
2300/30  . . . Load ramps
2300/32  . . . Track vehicles
2300/322  . . . Snowmobiles
2300/34  . . . Ambulances
2300/36  . . . Independent Multi-axle long vehicles
2300/37  . . . Vehicles having steerable wheels mounted on a vertically moving column
2300/38  . . . Low or lowerable bed vehicles
2300/40  . . . Variable track or wheelbase vehicles
2300/402  . . . Extra load carrying wheels, e.g. tag axles
2300/45  . . . Rolling frame vehicles
2300/50  . . . Electric vehicles; Hybrid vehicles
2300/60  . . . Vehicles using regenerative power
Indexing codes relating to the type of sensors based on the principle of their operation

2401/00

2401/10 . Piezoelectric elements
2401/11 . Electrostrictive transducers
2401/12 . Strain gauge
2401/122 . Wheatstone bridge circuit
2401/14 . Photo or light sensitive means, e.g. Infrared
2401/142 . Visual Display Camera, e.g. LCD
2401/144 . Fiber optic sensor
2401/15 . Doppler effect
2401/16 . GPS track data
2401/17 . Magnetic/Electromagnetic
2401/172 . Hall effect
2401/174 . Radar
2401/176 . Radio or audio sensitive means, e.g. Ultrasonic
2401/19 . Speech recognising means
2401/20 . Switches, e.g. mercury or ball type switches
Indexing codes relating to particular elements, systems or processes used on suspension systems or suspension control systems

- Retarders, delaying means, dead zones, threshold values, cut-off frequency, timer interruption
- Means for informing, instructing or displaying
- Monitoring means
- Involving data transmission, e.g. via satellite or GPS; for data monitoring, telemetry or platooning purposes
- Alarm means
- Inhibiting means
- Failure or malfunction detecting means
- Sensor drift
- Supervisory systems
- Redundant systems
- Feedback signal
- Feedforward signal
- Sampling or average detecting; Addition or subtraction
- Summation signal
- Error signal
- Differentiating means, i.e. differential control
- Integrating means, i.e. integral control
- Proportional control, i.e. gain control
- Feedforward signal
- Proportional control means
- Active control means
- Semi-Active control means
- Analogue Controller Details and Signal Treatment
- Digital Controller Details and Signal Treatment
- Optimal control; Kalman Filters
- Observer; Luaponov function
- Model Following
- Modal analysis
- Other parameter or state estimation methods not involving the mathematical modelling of the vehicle
- Artificial intelligence
- Adaptive Control
- Neural Networks
- Fuzzy Logic Control
- Spectral analysis; Transformations
- Integral
- Fourier
- z-transform
- Laplace
- Euler equations
- Statistical analysis
- Manual control or setting means
- using a remote, e.g. cordless, transmitter or receiver unit
- Joystick actuated suspension
- Control-by-wire
- Self-controlled or adjusted
- Magnetic elements
- permanent magnets
- Electromagnets; Solenoids
- Temporary fluctuations
- SISO system, i.e. single input - single output system

Indexing codes relating to the type of movement or to the condition of the vehicle and to the end result to be achieved by the control action

- Attitude or posture control
- Rolling condition
- Roll rigidity ratio; Warping
- Roll-over conditions
- Pitch; Nose dive
- Yawing condition
- Inclination due to load distribution or road gradient
- longitudinal with regard to vehicle
- transversal with regard to vehicle
- Running
- Reducing road induced vibrations
- Heaving; Squatting
- Platooning
- Starting, accelerating
- Traction
- Stationary vehicle
- kneeling, e.g. for letting passengers on/off
- lowering the floor for loading/unloading
- adjusting floor height to the loading ramp level
- using an anticreep mechanism to lock the height
- jacking-up for changing tyre or vehicle inspection
- Traction, slip, skid or slide control
- Transversal; Side-slip during cornering
- by applying forward/backward torque on each wheel individually
- by varying the load distribution
- by applying a braking action on each wheel individually
- Braking, stopping
- during collision
- automatically, based on dangerous living style
- automatically, based on stopping at a preset or target point position
- Steering, cornering
### Obstacle avoidance manoeuvre
- Estimating or calculating vehicle parameters or state variables
- Improving accuracy of a sensor signal
- Calibrating of a sensor, e.g. automatically
- Predicting unorthodox driving conditions for safe or optimal driving
- Detection or control after a system or component failure
- Diagnostics

### System configuration based on vehicle type or model
- System Controller type
- Suspension Control
- Attitude Control; levelling control
- ARS - Anti-Roll System Control
- Active Body Control [ABC]
- Roll-over protection systems, e.g. for warning or control

### Height Control System
- Suspension load distribution
- Body Vibration Control
- ABS - Brake Control
- EBV - Electronic brake force distribution
- Airbag deployment systems
- Skid or slide control [ASR]
- Electronic Stability Program (ESP, i.e. ABS +ASC+EMS)
- Automatic Traction or Slip Control [ATC]
- Electronic driving torque distribution
- Four-wheel drive
- ASC - Assisted or power Steering control
- Four-wheel steering
- Steer-by-wire
- Auto-navigation
- Automatic or driver-independent manoeuvre, e.g. for obstacle avoidance or roll-over prevention

### Engine Management System [EMS]
- Electronic Differential Lock [EDS]
- Intelligent Transportation System or Bus [IDB]
- Active Cruise Control, e.g. DISTRONIC type
- Tyre Pressure Monitoring Systems