

G05D

SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

Definition statement

This place covers:

Systems for controlling or regulating non-electric variables, in particular: position, trajectory, attitude or altitude of a vehicle; position or direction of an object; thickness or size of materials; flow rate; level; quantity ratio; linear or angular speed; force or stress; fluid pressure; torque or mechanical power; vibrations; chemical variables; humidity; temperature; viscosity; and illumination.

"controlling" means influencing a variable in any way, e.g. changing its direction or its value (including changing it to or from zero), maintaining it constant, limiting its range of variation.

"regulation" means maintaining a variable automatically at a desired value or within a desired range of values. The desired value or range may be fixed, or manually varied, or may vary with time according to a predetermined "programme" or according to variation of another variable. Regulation is a form of control.

Merely acting on a variable for the purpose of influencing the state of a system (e.g. acting on the fuel flow rate in an engine for achieving a certain speed), where the value of the variable itself remains irrelevant, should a priori not be considered as controlling or regulating said variable.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control or measuring arrangements specially adapted for combines	A01D 41/127
Control or regulation of milking machines	A01J 5/007
Controlling or regulating processes or operations for continuous casting of metals	B22D 11/16
Automatic control of welding parameters	B23K 9/095
Control systems or devices for copying directly from a pattern or a master model	B23Q 35/00
Grinding controlled by patterns, drawings, magnetic tape or the like	B24B 17/00
Control means for lapping machines or devices	B24B 37/005
Measuring or gauging equipment for controlling the feed movement of the grinding tool or work	B24B 49/00
Controlling the flowability, constitution, or other physical characteristics of abrasive blasts	B24C 7/00
Flow- or pressure-control devices or systems for dispensing beverages on draught	B67D 1/12
Control devices specially adapted for fluidised bed combustion apparatus	F23C 10/28
Humidity or temperature control in electrographic, electrophotographic or magnetographic processes	G03G 21/20
Arrangements for controlling dynamo-electric motors or generators	H02P 5/00 - H02P 9/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Valves per se	F16K
Measuring or testing	G01
Features of general applicability to regulating systems, e.g. anti-hunting arrangements	G05B
Systems for regulating electric or magnetic variables	G05F

Special rules of classification

Control systems specially adapted for particular apparatuses, machines or processes are classified in the subclasses for the apparatus, machine or process, provided that there is specific provision for control or regulation relevant to the special adaptation, either at a detailed level, (e.g. [A21B 1/40](#): "for regulating temperature in bakers' ovens") or at a general level, (e.g. [B23K 9/095](#): "for automatic control of welding parameters in arc welding"). Controlling aspects of space crafts are excluded from the [G05D](#). They should be classified in [B64G 1/244](#). Otherwise, classification is made in the most appropriate place in this subclass.

Places where there is specific provision of the kind referred to above at a detailed level have been listed under the main groups of this subclass (see "References relevant to classification in this subclass"). Where the provision is at a general level (e.g. of a kind appropriate to more than one of the main groups specified in the lists, or to main groups [G05D 27/00](#) or [G05D 29/00](#)), the places are listed under this subclass.

A document that can be applied to two or more applications is not specific for any of them and has to be classified in [G05D](#) (for instance a thermostat for heating or air conditioning).

A formulation of the kind "regulator for the application X" should a priori not be considered as specific to said application.

Usually, the subdivisions of the regulation classes in the field of the application are less precise than in [G05D](#), therefore giving a class in [G05D](#) may be useful for search.

When in a document there is mention of several controlled variables, one should try to visualize the block scheme of the regulation. The document is then to be classified in the group of the variable controlled in the outer control loop. In case the regulation in one of the other control loops is of particular interest, it should also be classified in the group(s) of the variable(s) concerned.

Note that the above is without prejudice of the limiting references contained in the titles of the different groups and subgroups in this subclass.

In the main groups of this subclass, remarks found under "Further details of subgroups" are not meant to replace the definitions in the titles, but either give further information about the definitions or mention particular types of documents to be classified in the subgroups or to be excluded from them. In case no remark is made on a given subgroup, the title is considered to be self-explanatory.

In [G05D](#), the hierarchy in classification is generally done according:

- to the physical variable
- Then to the nature of the auxiliary power used, with the following possibilities, not used for all the variables:
 - without auxiliary power (purely mechanical regulation)
 - with auxiliary non-electric power (e.g. pneumatic or hydraulic)
 - characterised by the use of electric means
 - with combination of electric and non-electric auxiliary power

- Then, to the type of sensor used.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Systems	includes self-contained devices such as speed governors, pressure regulators
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G05D 1/00

Control of position, course, altitude or attitude of land, water, air or space vehicles, e.g. using automatic pilots (drive control systems specially adapted for autonomous road vehicles [B60W 60/00](#))

Definition statement

This place covers:

Autonomous, remote or assisted control of the position, course, altitude, depth or attitude of land, water, air or space manned or unmanned vehicles.

Relationships with other classification places

Subclass [G01C](#) covers measuring distance or height, e.g. measuring distance or height for land vehicles, ships, aircraft and space vehicles. Group [G01C 21/00](#) covers navigation in general, e.g. determining the route to be followed by a vehicle. Group [G01C 21/00](#) also covers determining position or distance traveled using dead reckoning and inertial sensors.

Subclass [G08G](#) covers arrangements, located in land, water, air or space vehicles or on the ground, for controlling road vehicles, marine craft or aircraft within a traffic environment, e.g. traffic signals, landing aids or anti-collision systems. Subclass [G08G](#) does not cover arrangements for the control of position, course, altitude or attitude of land, water, air or space vehicles, not being specific to a traffic environment, e.g. automatic pilots, which are covered by group [G05D 1/00](#).

Subclass [G01S](#) covers systems and devices for determining positions, distances, velocities or directions using radio, optical, acoustic or similar waves. Subclass [G01S](#) also covers detecting the presence of an object using these waves.

This main group concerns only the position, course, altitude, depth or attitude control of vehicles as a whole. It does not cover internal adjustments of elements of the vehicles, like for example robotic arms, cranes, gimbal cameras or other types of payloads.

References

Limiting references

This place does not cover:

Drive control systems specially adapted for autonomous road vehicles	B60W 60/00
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Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steering or guiding agricultural machines or implements	A01B 69/00
Steering for toy vehicles	A63H 17/36
Electrical remote-control arrangements for toy vehicles	A63H 30/02

Stability or attitude control of air-cushion vehicles	B60V 1/11
Purposes of road vehicle drive control systems not related to the control of a particular subunit	B60W 30/00
Control of rail vehicles	B61L 23/00
Steering controls of motor vehicles or trailers, i.e. means for initiating a change of direction	B62D 1/00
Arrangements for automatically controlling the steering depending on driving conditions	B62D 6/00
Active steering aids	B62D 15/025
Attitude or position control of chassis of endless-tracked vehicles	B62D 55/116
Control of attitude or depth of underwater vessels	B63G 8/14
Marine steering; Marine dynamic anchoring	B63H 25/00
Control systems for actuating flying-control surfaces, lift-increasing flaps, air brakes or spoilers of aircraft	B64C 13/00
Attitude, flight direction or altitude control of aircraft by jet reaction	B64C 15/00
Ejector seats	B64D 25/10
Guiding or controlling cosmonautic vehicles	B64G 1/24
Control devices for conveyors	B65G 43/00
Control systems for cranes	B66C 13/18
Control devices for soil-shifting machines	E02F 9/20
Onboard guidance or control of self-propelled or guided missiles	F42B 15/01
Steering control of marine torpedoes	F42B 19/01

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of position or direction of an object not being a vehicle	G05D 3/00
Control of linear or angular speed or of acceleration	G05D 13/00
Mowers	A01D 34/00
Electric equipment of suction cleaners	A47L 9/28
Program-controlled manipulators	B25J 9/00
Safety devices for propulsion unit control	B60K 28/00
Vehicle fittings, acting on a single subunit only, for automatically controlling vehicle speed	B60K 31/00
Ground or aircraft carrier deck installations	B64F
Unmanned aerial vehicles	B64U
Fork lifts	B66F 9/00
Direction control systems for self-propelled missiles	F41G 7/00
Navigation	G01C 21/00
Determining positions, velocities, directions or distances using radio, optical or acoustic waves	G01S
Total factory control	G05B 19/418

Machine learning	G06N 20/00
Optimisation of routes or paths specially adapted for administration or management purposes	G06Q 10/047
Logistics and inventory or stock management	G06Q 10/08
Traffic control systems	G08G

Special rules of classification

In this main group, it is desirable to add the indexing codes of groups [G05D 2101/00](#) - [G05D 2111/00](#). These groups should be used for embodiments which are useful for search purposes, not just for possible alternatives mentioned in a list.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

vehicle	is any machine for transporting or moving for other purposes which comprises means for adjusting its position within an environment without being constrained with respect to a fixed location. This covers, e.g. moving robots, land vehicles, ships, submarines, airplanes, drones or space vehicles.
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G05D 1/12 (Frozen)

Target-seeking control

Definition statement

This place covers:

Control of vehicle position to acquire, maintain or re-acquire a target, e.g. a person or another vehicle, for tracking, following or interdiction purposes.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Direction control systems for self-propelled missiles	F41G 7/00
Analysis of motion	G06T 7/20
Target detection	G06V 2201/07

G05D 1/20

Control system inputs

Definition statement

This place covers:

Inputs used by the control system to control the position, course, altitude, depth or attitude of the vehicle. It comprises position, course, altitude or attitude command inputs from an offboard human operator or from an external computer system, as well as onboard and offboard arrangements for determining the position or orientation of the vehicle in relation to its environment used for the specific

Definition statement

purpose of position, course, altitude or attitude control. This place further covers allocation of control inputs between offboard and onboard operators and systems.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring height	G01C 5/00
Gyroscopes	G01C 19/00
Navigation	G01C 21/00
Measuring distance traversed on the ground by vehicles, e.g. using odometers	G01C 22/00
Combined instruments indicating more than one navigational value, e.g. for aircraft; Combined measuring devices for measuring two or more variables of movement, e.g. distance, speed or acceleration	G01C 23/00
Positioning beacons, e.g. LORAN, VOR or TACAN systems	G01S 1/00
Determining the direction from which radio, optical or acoustic waves are being received	G01S 3/00
Determining position or attitude using radio, optical or acoustic waves	G01S 5/00
Details of systems according to groups G01S 13/00 , G01S 15/00 , G01S 17/00	G01S 7/00
Determining distance or velocity using radio, optical or acoustic waves and not using reflection or reradiation	G01S 11/00
Systems using the reflection or reradiation of radio waves, e.g. radar systems; Analogous systems	G01S 13/00
Systems using the reflection or reradiation of acoustic waves, e.g. Sonar systems	G01S 15/00
Systems using the reflection or reradiation of electromagnetic waves other than radio waves, e.g. Lidar systems	G01S 17/00
Satellite radio beacon positioning systems, e.g. GPS; Determining position, velocity or attitude using signals transmitted by such systems	G01S 19/00
Control devices characterised by mechanical features only	G05G
Input arrangements for transferring data to be processed into a form capable of being handled by the computer; Output arrangements for transferring data from processing unit to output unit, e.g. interface arrangements	G06F 3/00
Image analysis	G06T 7/00
Image or video recognition of scenes	G06V 20/00
Arrangements for transmitting signals characterised by the use of a wireless electrical link	G08C 17/00
Transmission	H04B
Details of television systems	H04N 5/00
Wireless communication networks for vehicles	H04W 4/40

G05D 1/22

Command input arrangements

Definition statement

This place covers:

Position, course, altitude or attitude command input arrangements to the control system of a semi-autonomous, fully autonomous or remote-controlled vehicle. In particular, position, course, altitude or attitude command input arrangements for establishing, influencing or constraining the target position, course, altitude or attitude of the vehicle.

Relationships with other classification places

Command input arrangements for human pilots or operators located onboard vehicles are classified in classes [B62](#), [B63](#) or [B64](#).

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Steering controls for land motor vehicles or trailers	B62D 1/00
Marine steering	B63H 25/00
Initiating means actuated personally for actuating flying-control surfaces, lift-increasing flaps, air brakes or spoilers	B64C 13/04

G05D 1/221

Remote-control arrangements

Definition statement

This place covers:

Position, course, altitude or attitude command input arrangements from an offboard operator or from an external computer system.

Feedback arrangements from the vehicle to the offboard operator or external computer system for the purpose of position, course, altitude or attitude control.

G05D 1/224

Output arrangements on the remote controller, e.g. displays, haptics or speakers

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Flight directors	G01C 23/005
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G05D 1/226

Communication links with the remote-control arrangements

Definition statement

This place covers:

Networking arrangements or signal aspects of the communication link between an offboard operator or an external computer system and a vehicle for the purpose of position, course, altitude or attitude control.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for transmitting signals characterised by the use of a wireless electrical link	G08C 17/00
Transmission	H04B
Wireless communication networks specially adapted for vehicles	H04W 4/40

G05D 1/227

Handing over between remote control and on-board control; Handing over between remote control arrangements

Definition statement

This place covers:

Handover of control between multiple offboard operators or external computer systems, or between onboard and offboard operators or external computer systems.

G05D 1/228

Command input arrangements located on-board unmanned vehicles

Definition statement

This place covers:

Position, course, altitude or attitude command input arrangements mounted on an unmanned vehicle to be used by operators or systems located off board the vehicle.

G05D 1/229

Command input data, e.g. waypoints

Definition statement

This place covers:

Details of position, course, altitude or attitude command input data, e.g. waypoints, to the control system of a vehicle.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Flight plan management traffic control systems for aircraft	G08G 5/30
Navigation or guidance aids for a single aircraft in accordance with predefined flight zones, e.g. to avoid prohibited zones	G08G 5/55 in combination with G08G 5/59

G05D 1/24

Arrangements for determining position or orientation

Definition statement

This place covers:

Onboard or offboard arrangements for determining the position or orientation of a vehicle in relation to its environment used for the specific purpose of position, course, altitude or attitude control of the vehicle.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Altimeters for aircraft	G01C 5/005
Gyroscopes	G01C 19/00
Navigation	G01C 21/00
Measuring distance traversed on the ground by vehicles, e.g. using odometers	G01C 22/00
Positioning beacons, e.g. LORAN, VOR or TACAN systems	G01S 1/00
Determining the direction from which radio, optical or acoustic waves are being received	G01S 3/00
Determining position or attitude using radio, optical or acoustic waves	G01S 5/00
Details of systems according to groups G01S 13/00 , G01S 15/00 , G01S 17/00	G01S 7/00
Determining distance or velocity using radio, optical or acoustic waves and not using reflection or reradiation	G01S 11/00
Systems using the reflection or reradiation of radio waves, e.g. radar systems; Analogous systems	G01S 13/00
Systems using the reflection or reradiation of acoustic waves, e.g. sonar systems	G01S 15/00
Systems using the reflection or reradiation of electromagnetic waves other than radio waves, e.g. lidar systems	G01S 17/00
Satellite radio beacon positioning systems, e.g. GPS; Determining position, velocity or attitude using signals transmitted by such systems	G01S 19/00
Image analysis	G06T 7/00
Image or video recognition or understanding of scenes or scheme-specific elements	G06V 20/00

Details of television systems	H04N 5/00
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Special rules of classification

In this place, it is desirable to add the indexing codes of group [G05D 2111/00](#) for specifying details of the particular signals, which are useful for search purposes.

G05D 1/246

using environment maps, e.g. simultaneous localisation and mapping [SLAM]

Definition statement

This place covers:

Arrangements for determining the position or orientation of the vehicle in relation to a representation or model of the environment for the specific purpose of position, course, altitude or attitude control of the vehicle.

G05D 1/40

Control within particular dimensions

Definition statement

This place covers:

Control arrangements specific for the control of position or course of a vehicle within two dimensions or three dimensions.

Control arrangements specific for the control of altitude, depth or attitude of a vehicle.

G05D 1/43

Control of position or course in two dimensions [2D]

Definition statement

This place covers:

Position or course control in two dimensions, for example, over a solid or liquid surface or inside a fluid at constant altitude or depth. The surface may be horizontal, vertical, inclined or uneven, for example.

G05D 1/435

resulting in a change of level, e.g. negotiating lifts or stairs

Definition statement

This place covers:

Control of a vehicle in two dimensions, wherein features of the surface or of the environment, like the presence of inclined planes, stairs or lifts, results in a change in the altitude or depth of the vehicle during the two-dimensional control.

G05D 1/46**Control of position or course in three dimensions [3D]****Definition statement***This place covers:*

Position or course control in three dimensions for vehicles controllable within three dimensions.

G05D 1/461**for unpowered vehicles, e.g. gliders or parachutes****Definition statement***This place covers:*

Control in three dimensions of a vehicle having no active propulsion.

Special rules of classification

In this place, the vehicle that has no active propulsion is considered to be "unpowered" for propulsion purposes, but this vehicle may otherwise have internally-powered elements, e.g. control surface actuators.

G05D 1/467**for movement inside a confined volume, e.g. indoor flying****Definition statement***This place covers:*

Three-dimensional control of a vehicle moving inside a volume defined by physical surfaces, e.g. having solid or liquid surfaces as boundaries, regardless of the size or accessibility of the volume. For example, tanks, pools or buildings.

Special rules of classification

An open body of water is not considered to be a confined volume for this place.

G05D 1/48**Control of altitude or depth****Definition statement***This place covers:*

Control arrangements for achieving a desired altitude, depth, vertical speed or vertical profile.

G05D 1/49**Control of attitude, i.e. control of roll, pitch or yaw****Definition statement***This place covers:*

Attitude control comprising direct isolated or combined control of yaw, pitch and roll.

G05D 1/60

Intended control result

Definition statement

This place covers:

The intended result of the position, course, altitude, depth or attitude control of a single vehicle or of a coordinated group of vehicles, i.e. the goal or purpose that the position, course, altitude or attitude control of the vehicle is meant to achieve through the control.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Anti-collision traffic control systems for road vehicles	G08G 1/16
Anti-collision traffic control systems for aircraft	G08G 5/80

G05D 1/617

Safety or protection, e.g. defining protection zones around obstacles or avoiding hazards (arrangements for controlling the position or course of two or more vehicles for avoiding collisions therebetween [G05D 1/693](#); arrangements for reacting to or preventing system or operator failure [G05D 1/80](#))

Definition statement

This place covers:

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at ensuring safety and protection of the vehicle, its occupants or its environment during operation of the vehicle.

References

Limiting references

This place does not cover:

Arrangements for controlling the position or course of two or more vehicles for avoiding collisions therebetween	G05D 1/693
Arrangements for reacting to or preventing system or operator failure	G05D 1/80

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for monitoring atmospheric conditions used in traffic control systems for aircraft	G08G 5/76
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G05D 1/618**{for cargo or occupants}****Definition statement***This place covers:*

Controlling the movement of the vehicle in order to prevent or minimize harm or injury to cargo or occupants.

G05D 1/619**{Minimising the exposure of a vehicle to threats, e.g. avoiding interceptors}****Definition statement***This place covers:*

Controlling the movement of the vehicle in order to prevent or minimize the exposure of a vehicle to an attack or detection by hostile entities.

G05D 1/622**Obstacle avoidance (predicting or avoiding probable or impending collision of road vehicles [B60W 30/08](#))****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at detecting objects during travel and modifying the movement of the vehicle to maintain at least a minimum distance to them.

References**Limiting references***This place does not cover:*

Predicting or avoiding probable or impending collision of road vehicles	B60W 30/08
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Informative references*Attention is drawn to the following places, which may be of interest for search:*

Arrangements for monitoring terrain used in traffic control systems for aircraft	G08G 5/74
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G05D 1/639**Resolving or avoiding being stuck or obstructed****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at resolving or avoiding situations where the movement of the vehicle is constrained so as to substantially hinder the intended task of the vehicle.

G05D 1/642**{involving obstacle removal, e.g. opening doors or pushing furniture}****Definition statement***This place covers:*

Arrangements for temporarily or permanently removing or relocating obstacles that hinder the movement of the vehicle.

G05D 1/644**Optimisation of travel parameters, e.g. of energy consumption, journey time or distance****Definition statement***This place covers:*

Arrangements for optimisation of travel parameters by modifying the position, course, altitude or attitude control of the vehicle during operation.

References**Informative references***Attention is drawn to the following places, which may be of interest for search:*

Route searching or route guidance specially adapted for navigation in road networks	G01C 21/34
Optimisation of routes or paths specially adapted for administration or management purposes, e.g. travelling salesman problem	G06Q 10/047

G05D 1/6445**{for optimising payload operation, e.g. camera or spray coverage}****Definition statement***This place covers:*

Arrangements for controlling the position, course, altitude or attitude of the vehicle for optimising payload operation of a component or load carried by the vehicle.

References**Informative references***Attention is drawn to the following places, which may be of interest for search:*

Control of position, course, altitude or attitude of land, water, air or space vehicles with the intended control result of interaction with payloads or external entities	G05D 1/656
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G05D 1/648**Performing a task within a working area or space, e.g. cleaning****Definition statement***This place covers:*

Controlling the movement of the vehicle within a space or over a surface to perform a work operation that changes the characteristics of the space or surface.

G05D 1/6484**{by taking into account parameters or characteristics of the working area or space, e.g. size or shape}****Definition statement***This place covers:*

Controlling the movement of the vehicle by taking into account the physical parameters or characteristics of the working area or space, e.g. boundaries or surface features.

G05D 1/65**Following a desired speed profile****Definition statement***This place covers:*

Arrangements for directly controlling, limiting or otherwise influencing the travel speed or acceleration of a semi-autonomous, fully autonomous or remote-controlled vehicle over a route or at a given point or area.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Control of linear speed; Control of angular speed; Control of acceleration or deceleration	G05D 13/00
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G05D 1/6542**{on a moving platform, e.g. aircraft carrier}****Definition statement***This place covers:*

Arrangements for controlling landing on a moving platform, while it is moving.

G05D 1/656**Interaction with payloads or external entities****Definition statement**

This place covers:

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at allowing a desired operation of, or interaction with, internal or external entities to the vehicle.

Relationships with other classification places

Controlled ordnance, e.g. missiles or bombs, interacting with external entities is not classified in this place, but is classified in groups [F41G 7/00](#) or [F42B 15/01](#).

G05D 1/661**Docking at a base station (delivering or retrieving payloads [G05D 1/667](#))****Definition statement**

This place covers:

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at achieving a desired relative position and orientation at zero relative velocity to an external facility in order to allow interaction between the facility and the vehicle, the external facility typically being cooperative or comprising features for allowing relative positioning of the vehicle.

References**Limiting references**

This place does not cover:

Delivering or retrieving payloads	G05D 1/667
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G05D 1/665**{Releasing payloads, e.g. parachutes}****Definition statement**

This place covers:

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at achieving a target position or orientation of the vehicle for the appropriate release of a payload, e.g. in order to achieve the landing of a parachute at a desired spot, or in order to achieve a desired trajectory for a released missile or torpedo.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Systems for controlling missiles or projectiles, not provided for elsewhere, for guiding a craft to a correct firing position	F41G 9/002
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G05D 1/667**Delivering or retrieving payloads****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at placing a payload at a target location or retrieving a payload from a target location.

G05D 1/672**Positioning of towed, pushed or suspended implements, e.g. ploughs****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of vehicles specifically aimed at achieving a desired position, orientation or course of an implement or another piece of equipment being towed or pushed by the vehicle or suspended from it.

G05D 1/678**for tethered vehicles (positioning towed, pushed or suspended implements [G05D 1/672](#))****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of a vehicle physically coupled by a tether, e.g. cable, to a fixed or moving entity.

References**Limiting references***This place does not cover:*

Positioning towed, pushed or suspended implements	G05D 1/672
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G05D 1/683**Intercepting moving targets (docking at a base station [G05D 1/661](#))****Definition statement***This place covers:*

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at reducing the distance to a moving uncooperative target to zero, where the final orientation and relative velocity are typically not controlled.

References**Limiting references***This place does not cover:*

Docking at a base station	G05D 1/661
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G05D 1/686

Maintaining a relative position with respect to moving targets, e.g. following animals or humans (for pointing payloads towards targets [G05D 1/689](#); involving controlling the position or course of two or more vehicles [G05D 1/69](#))

Definition statement

This place covers:

Position, course, altitude, depth or attitude control of a vehicle specifically aimed at maintaining a desired relative position with respect to an independently moving target.

References**Limiting references**

This place does not cover:

Pointing payloads towards targets	G05D 1/689
Coordinated control of the position or course of two or more vehicles	G05D 1/69

G05D 1/69

Coordinated control of the position or course of two or more vehicles

Definition statement

This place covers:

Control of the position or course of each of two or more vehicles in coordination with each other by taking into account the position or course of each of the vehicles.

G05D 1/692

involving a plurality of disparate vehicles

Definition statement

This place covers:

Arrangements for the coordinated position or course control of two or more vehicles that are substantially different from a point of view of position control or structure. For example, coordinated control of an air vehicle and a land vehicle, coordinated control of a fixed wing aircraft and a rotorcraft, or coordinated control of a holonomic vehicle and a non-holonomic vehicle.

G05D 1/693

for avoiding collisions between vehicles

Definition statement

This place covers:

Coordinated position or course control of two or more vehicles for the specific purpose of avoiding collisions between them.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Anti-collision traffic control systems for road vehicles	G08G 1/16
Traffic collision avoidance systems for aircraft	G08G 5/80

G05D 1/695

for maintaining a fixed relative position of the vehicles, e.g. for convoy travelling or formation flight

Definition statement

This place covers:

Arrangements for controlling two or more vehicles with the purpose of maintaining a desired relative distance or orientation to each other.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Platooning in road vehicles	G08G 1/22
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G05D 1/696

{involving a plurality of vehicles coupled together}

Definition statement

This place covers:

Arrangements for controlling two or more independently controlled vehicles that are temporarily linked together by a shared payload or a physical coupling.

G05D 1/698

Control allocation

Definition statement

This place covers:

Processes and systems for allocating the authority for providing commands for the coordinated control of two or more vehicles between one or more of the vehicles or external entities. Includes shared or sequential allocation of the authority.

G05D 1/6983**{by distributed or sequential control}****Definition statement***This place covers:*

Coordinated control of the position or course of two or more vehicles, wherein the command signals for the coordinated control are generated by two or more of the vehicles, either sequentially (e.g. by token passing) or simultaneously (e.g. by negotiating between the vehicles).

G05D 1/6985**{using a lead vehicle, e.g. primary-secondary arrangements}****Definition statement***This place covers:*

Coordinated control of the position or course of a group of two or more vehicles, wherein the command signals for the coordinated control are generated centrally by one single vehicle of the group acting as a lead vehicle.

G05D 1/6987**{by centralised control off-board any of the vehicles}****Definition statement***This place covers:*

Coordinated control of the position or course of a group of two or more vehicles, wherein the command signals for the coordinated control are generated centrally by an entity external to the group of vehicles.

G05D 1/80

Arrangements for reacting to or preventing system or operator failure (handing over between remote control and on-board control, or handing over between remote control arrangements [G05D 1/227](#))

Definition statement*This place covers:*

Safety arrangements relating to position, course, altitude, depth or attitude control of a vehicle for reacting to or preventing abnormal system operation caused by failures or errors of a system or a human operator.

References**Limiting references***This place does not cover:*

Handing over between remote control and on-board control, or handing over between remote control arrangements	G05D 1/227
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Informative references

Attention is drawn to the following places, which may be of interest for search:

Ensuring safety in case of road vehicle drive control system failures not related to the control of a particular subunit	B60W 50/02
Interaction between the driver and the road vehicle drive control system not related to the control of a particular subunit	B60W 50/08
Testing of vehicles	G01M 17/00
Electric safety arrangements in general	G05B 9/02
Electric testing or monitoring of control systems	G05B 23/02
Preventing errors by testing or debugging of software	G06F 11/36
Computer-aided design of vehicles	G06F 30/15
Registering or indicating the working of vehicles	G07C 5/00
Alarm systems	G08B

G05D 1/82

Limited authority control, e.g. enforcing a flight envelope (limitation of acceleration or structural stress [G05D 1/83](#))

Definition statement

This place covers:

Systems limiting the allowed control by the operator or system, e.g. limiting the control output to an amount less than commanded by the operator of a vehicle when it is determined that there is a risk associated with implementing the commanded output.

References**Limiting references**

This place does not cover:

Limitation of acceleration or structural stress	G05D 1/83
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G05D 1/85

Fail-safe operations, e.g. limp home mode

Definition statement

This place covers:

Arrangements for achieving a safe degraded operation of a vehicle in response to certain conditions, e.g. limp home mode.

G05D 1/86**Monitoring the performance of the system, e.g. alarm or diagnosis modules****Definition statement**

This place covers:

Arrangements for monitoring the performance of the position, course, altitude or attitude control system. A detected performance abnormality may trigger action by the control system or by elements external to the control system, e.g. warnings.

G05D 1/87**using redundant control arrangements****Definition statement**

This place covers:

Arrangements for reacting to or preventing system or operator failure, comprising two or more elements of the control system capable of performing the same function redundantly, e.g. redundant sensors, processors or software modules.

G05D 3/00**Control of position or direction ([G05D 1/00](#) takes precedence; numerical control to execute positioning [G05B 19/18](#))****References****Limiting references**

This place does not cover:

Control of position, course, altitude, or attitude of land, water, air or space vehicles, e.g. automatic pilot	G05D 1/00
Numerical control to execute positioning	G05B 19/18

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Controlling mechanisms of shoe machines	A43D 119/00
Control devices specially adapted for positioning tool carriers in forging or pressing	B21K 31/00
Pattern-controlled boring or drilling tools	B23B 39/26
Planing or slotting machines controlled by copying device	B23D 1/30 , B23D 3/06 , B23D 5/04
Controlling electrode to workpiece spacing in electric discharge and electrochemical machining	B23H 7/18
Positioning the workpiece in working by laser, e.g. welding or cutting	B23K 26/02
Positioning the workpiece in soldering, welding or cutting by applying heat locally, not otherwise provided for	B23K 37/04

Positioning the molten metal in soldering or welding, not otherwise provided for	B23K 37/06
Adjusting or stopping spindles in machine tools	B23Q 5/20
Automatic control of position of tool or work; Precise positioning of tool or work into particular locations, not otherwise provided for	B23Q 15/00 , B23Q 16/00
Tools controlled by pattern or master model	B23Q 35/00
Equipment for exact control of the starting position in grinding	B24B 47/22
Control arrangements for presses	B30B 15/14 , B30B 15/16
Attitude or position control of chassis of tracked vehicles	B62D 55/116
Registering, tensioning, smoothing or guiding webs longitudinally by controlling or regulating web-advancing mechanisms	B65H 23/18
Control of dipper or bucket positions in dredgers	E02F 3/43
Fluid-pressure servomotors with follow-up action, i.e. in which the position of the actuated member conforms with that of the controlling member	F15B 9/00
Tracking of solar heat collectors	F24S 50/20
Positioning of originals, masks, frames, photographic sheets or textured or patterned surfaces in photomechanical production of patterned or textured surfaces	G03F 9/00
Controlling the position of the rotating heads in information storage systems	G11B 5/588
Means for moving control elements in nuclear reactors to desired positions	G21C 7/12

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of linear or angular speed or of acceleration	G05D 13/00
Program-controlled manipulators	B25J 9/00

G05D 3/12

using feedback

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Arrangements for regulating or controlling electric motors, appropriate for both AC and DC motors	H02P 29/00
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G05D 5/00

Control of dimensions of material

Definition statement

This place covers:

Control of thickness or size of material

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control devices for tobacco cutting	A24B 7/14
Control of the thickness of coating of fluent material on a surface	B05C 11/02
Control of the thickness, width, diameter or other transverse dimensions of the products of metal-rolling mills	B21B 37/16
Regulating dimensions of molten glass ribbon	C03B 18/04
Regulating the thickness of layers in paper making	D21F 7/06

G05D 7/00

Control of flow (level control [G05D 9/00](#); control of flow ratio [G05D 11/00](#))

Definition statement

This place covers:

Control of flow of liquids, gases, particulate matter and other fluent materials by action on throttling means and/or flow sources.

Further details of subgroups:

[G05D 7/0113](#)

This subgroup covers valves where the flexible member itself, e.g. a membrane, acts on the valve seat.

[G05D 7/012](#)

This subgroup covers for example flexible members having the form of a torus.

[G05D 7/0133](#)

This subgroup covers valves with a piston having one extreme facing the inlet chamber and an opposite extreme facing the outlet chamber.

[G05D 7/014](#) and [G05D 7/0153](#)

These subgroups cover valves in which at least part of the piston has the form of a cylindrical sleeve in contact with and sliding over a fixed or moving stem. They also cover valves in which the control chamber comprising the biasing member is surrounded by the controlled fluid

[G05D 7/0186](#)

This subgroup covers valves using calibrated orifices for achieving a constant flow.

[G05D 7/0611](#) and [G05D 7/0623](#)

These subgroups cover systems where the target flow is defined in dependence on a specific parameter, e.g. the speed of a vehicle.

References

Limiting references

This place does not cover:

Level control	G05D 9/00
Control of flow ratio	G05D 11/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Controlling the air quantity in hair drying helmets	A45D 20/26
Controlling flow of media to the human body	A61M 5/168
Controlling flow of gases or vapour in electrostatic separators	B03C 3/36
Control of fluent material in coating devices	B05C 11/10
Flow-control devices in apparatus or devices for dispensing beverages on draught	B67D 1/12
Automatic means for reducing or intermittently interrupting flow for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers	B67D 7/28
Controlling gas flow through gas purifiers	C10K 1/28
Controlling flow of drilling fluid for flushing boreholes	E21B 21/08
Controlling the flow of the obtained fluid to or in wells	E21B 43/12
Controlling by varying flow non-positive-displacement machines or engines	F01D 17/00
Controlling lubrication pressure or quantity	F01M 1/16
Control of coolant flow for cooling machines or engines in general, or for internal-combustion engines	F01P 7/00
Control of gas-turbine working fluid flow	F02C 9/16 , F02C 9/50
Throttle passages in pipes	F16L 55/027
Controlling air flow rate in air treatment arrangements	F24F 11/74
Controlling of air or gas flow in dryers	F26B 21/37
Controlling the rate of feed or discharge in continuous flow weighing apparatus	G01G 11/08
Control of nuclear power plant by varying flow of coolant	G21D 3/14

Special rules of classification

[G05D 7/0629](#)

Within this subgroup, an invention is classified in the last appropriate place.

G05D 9/00

Level control, e.g. controlling quantity of material stored in vessel

Definition statement

This place covers:

Control of quantity of liquids or particulate matter in a vessel by action on the input and/or the output flow.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Controlling the liquid level in sedimentation arrangements	B01D 21/34
Ink level control devices	B41L 27/04
Controlling water level for boilers	F22D 5/00
Controlling level of liquid in liquid pool electrodes in electric discharge tubes or lamps	H01J 1/10 , H01J 13/14

G05D 11/00

Control of flow ratio (control of chemical or physico-chemical variables, e.g. pH-value, [G05D 21/00](#); control of humidity [G05D 22/00](#); control of temperature by varying the mixing ratio of two fluids having different temperatures [G05D 23/13](#); control of viscosity [G05D 24/00](#))

Definition statement

This place covers:

Control of the relative ratio of flow rate or of volume of two or more fluent materials by action on throttling means and/or flow sources.

Further details of subgroups:

[G05D 11/005](#)

This subgroup also covers systems using interconnected pistons.

[G05D 11/006](#)

This subgroup covers systems comprising venturi aspirators.

[G05D 11/008](#)

This subgroup covers systems where the motor of the pump acting on the feeding of a fluid is operated by another fluid.

[G05D 11/03](#)

Subgroups [G05D 11/001](#) - [G05D 11/008](#) are used in preference to [G05D 11/03](#), also for flow ratio control systems without auxiliary power.

[G05D 11/16](#)

Definition statement

Systems aiming at regulating a temperature by mixing hot and cold water are only classified in [G05D 23/13](#) and subgroups.

References

Limiting references

This place does not cover:

Control of chemical or physico-chemical variables, e.g. pH-value	G05D 21/00
Control of humidity	G05D 22/00
Control of temperature by varying the mixing ratio of two fluids having different temperatures	G05D 23/13
Control of viscosity	G05D 24/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Density control in sedimentation arrangements	B01D 21/32
Forming predetermined ratios of substances to be mixed	B01F 35/80
Controlling the flowability of abrasive blasts	B24C 7/00
Controlling the operation of apparatus for producing mixtures of clays or cements	B28C 7/00
Control devices for bulk material conveyors	B65G 53/66
Controlling the flow ratio in jet-propulsion plants	F02K 3/075

G05D 13/00

Control of linear speed; Control of angular speed; Control of acceleration or deceleration, e.g. of a prime mover

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Controlling drum speed in metal drawing	B21C 1/12
Control of cutting velocity of tool or work	B23Q 15/00
Controlling ram speed in presses	B30B 15/20
Vehicle fittings, acting on a single sub-unit only, for automatically controlling vehicle speed	B60K 31/00
Devices for controlling the propulsion of electrically-propelled vehicles	B60L 15/00
Road vehicle cruise control	B60W 30/00
Control of cruising speed of aircraft	B64D 31/08
Control of feed rate in manufacture of artificial filaments, threads, fibres, bristles or ribbons	D01D 1/09
Speed control arrangements in carding machines	D01G 15/36

Automatically controlled speed driving mechanism in warping, beaming or leasing machines	D02H 13/14
Cyclically varying speed of looms	D03D 51/16
Control of speed of fluid carrier in chemical analysis	G01N 30/32
Controlling the speed of record carriers of filamentary or web form in information storage systems	G11B 15/46
Controlling the speed of record carriers not specifically of filamentary or web form in information storage systems	G11B 19/28

G05D 13/30

Governors characterised by fluid features in which the speed of a shaft is converted into fluid pressure

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Transducers converting variations of physical quantities into fluid-pressure variations	F15B 5/00
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G05D 13/34

with auxiliary non-electric power

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Fluid-pressure converters	F15B 3/00
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G05D 15/00

Control of mechanical force or stress; Control of mechanical pressure

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control devices for adjusting the force in portable percussive tools	B25D 9/26
Controlling ram pressure in presses	B30B 15/22
Controlling tension in webs, tapes, or filamentary material	B65H 23/00 , B65H 59/00
Controlling tension in filamentary material	B65H 59/00
Control devices for rope, cable or chain tension in load moving winding or unwinding mechanisms	B66D 1/50
Control of the tension in looms	D03D 49/04

Automatically-controlled tensioning devices in sewing machines	D05B 47/04
Means for regulating the pressure in paper-making machines	D21F 3/06
Controlling the tension during drying fabrics	F26B 13/12
Controlling the pressure of air or other gases for drying solid materials or objects	F26B 21/35
Control of record carrier tension in information storage arrangements	G11B 15/43

G05D 16/00

Control of fluid pressure

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Devices for controlling tyre pressure	B60C 23/00
Control of air pressure within diving suit	B63C 11/08
Automatic control of aircraft air-pressure	B64D 13/04
Control devices, e.g. for controlling gas pressure, for preventing jamming of material in bulk material conveyors	B65G 53/66
Control of pressure in the treatment of filament-forming material	D01D 1/09
Controlling pressure of drilling fluid for flushing boreholes	E21B 21/08
Controlling lubricant pressure	F01M 1/16
Control of pressure of fluid carrier in chemical analysis	G01N 30/32
Means for obtaining or maintaining pressure in electric discharge tubes or lamps	H01J 7/14
Means for obtaining or maintaining pressure in electric incandescent lamps	H01K 1/52

Informative references

Attention is drawn to the following places, which may be of interest for search:

Valves per se	F16K
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Special rules of classification

Groups [G05D 16/02](#), [G05D 16/024](#) and [G05D 16/028](#)

These groups describing functional aspects of the invention are generally used in combination with groups [G05D 16/04](#) - [G05D 16/2097](#) describing structural aspects of the valves.

Group [G05D 16/028](#)

This group covers valves controlling a difference between two systems pressures, excluding the following cases:

- When one of the pressures is the ambient (atmospheric) pressure or any other uncontrolled pressure that is external to the system; in this case only the structural aspects of the valve are classified in groups [G05D 16/04](#) – [G05D 16/2097](#).
- When the controlled pressures are across a fixed or adjustable restriction for the purpose of flow regulation, in which case the document should be classified in [G05D 7/00](#); and
- When one of the pressures is a reference pressure generated by a pilot valve or any other means for the purpose of keeping the other pressure at a difference to said reference pressure, in which case the document should be classified either in [G05D 16/14](#) or in [G05D 16/2093](#).

Groups [G05D 16/0402](#) and [G05D 16/0404](#)

These groups are used in combination with groups [G05D 16/06](#) – [G05D 16/12](#) describing one or more of the valves.

G05D 16/02

Modifications to reduce the effects of instability, e.g. due to vibrations, friction, abnormal temperature, overloading or imbalance

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Vibration-dampers	F16F 7/00
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G05D 16/0402

{with two or more controllers mounted in series}

Definition statement

This place covers:

- Valves in a series, where the output of one valve is the input of another one.

G05D 16/0404

{with two or more controllers mounted in parallel}

Definition statement

This place covers:

- Valves having their inputs and/or outputs connected together.

G05D 16/10

the sensing element being a piston or plunger

Definition statement

This place covers:

- Valves comprising a piston or plunger, which reacts to fluid pressure in contact therewith.

G05D 16/103

{the sensing element placed between the inlet and outlet (multiple-way valve [G05D 16/101](#))}

Definition statement

This place covers:

- Valves comprising a piston having one extreme facing the inlet chamber and an opposite extreme facing the outlet chamber, for example:

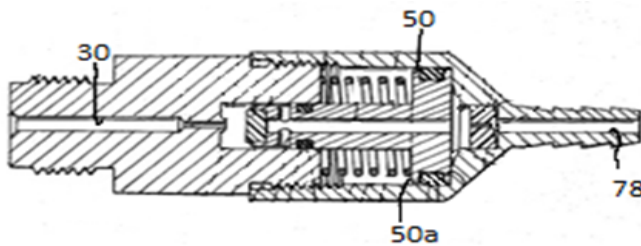


Figure 1. A piston 50 having one extreme 50a facing the inlet 30 and an opposite extreme facing the outlet chamber 78.

References**Limiting references**

This place does not cover:

Multiple-way valve	G05D 16/101
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G05D 16/106

{Sleeve-like sensing elements; Sensing elements surrounded by the flow path}

Definition statement

This place covers:

- Valves in which at least part of the piston has the form of a cylindrical sleeve in contact with and sliding over a fixed or moving stem.
- Valves in which the control chamber comprising the biasing member is surrounded by the controlled fluid, for example:

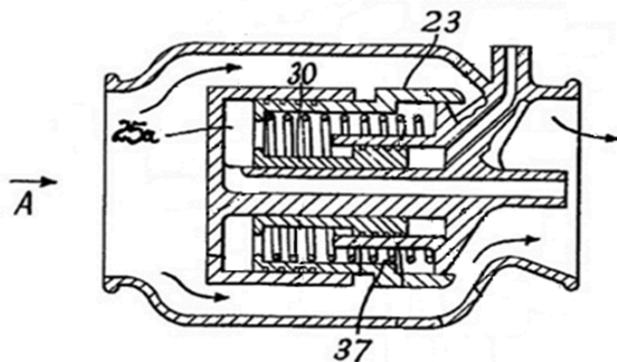


Figure 1. A part 30 of the piston 23 has the form of a cylindrical sleeve in contact with and sliding over a fixed stem 29. Furthermore, the control chamber 25a comprising the biasing member 37 is surrounded by the controlled fluid.

G05D 16/107

{with a spring-loaded piston in combination with a spring-loaded slideable obturator that move together over range of motion during normal operation}

Definition statement

This place covers:

- Valves having a detached obturator that is biased against the sensing piston so that they move together over the range of motion during normal operations, for example:

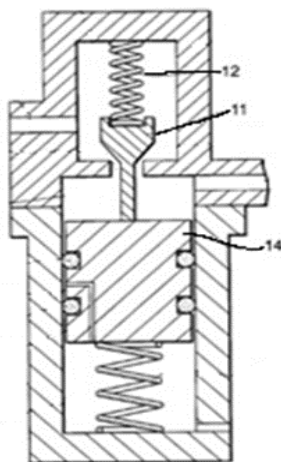


Figure 1. A detached obturator 11 is biased by the auxiliary spring 12 against the sensing piston 14 so that they move together over the range of motion during normal operations.

G05D 16/109

{with two or more pistons acting as a single pressure controller that move together over range of motion during normal operations (controllers mounted in series [G05D 16/0402](#), controller mounted in parallel [G05D 16/0404](#))}

Definition statement

This place covers:

- Valves comprising two or more pistons that move independently of each other over the range of motion during normal operation, at least one of them being the sensing element.

References

Limiting references

This place does not cover:

Control of fluid pressure without auxiliary power with two or more controllers mounted in series	G05D 16/0402
Control of fluid pressure without auxiliary power with two or more controllers mounted in parallel	G05D 16/0404

G05D 16/14**with auxiliary non-electric power****Definition statement***This place covers:*

- Valves in which the controlled pressure is compared to a reference fluid pressure generated by means of an auxiliary pilot valve or any other means.

G05D 16/16**derived from the controlled fluid****Special rules of classification**

This group may be used in combination with groups [G05D 16/06](#) – [G05D 16/12](#) describing structural details of the auxiliary pilot valve.

G05D 16/2006

{with direct action of electric energy on controlling means (combination of electric and non-electric auxiliary [G05D 16/2093](#))}

Definition statement*This place covers:*

- Electric energy acting on the main valve, and
- Electric energy acting on the control element of the pump

References**Limiting references***This place does not cover:*

With combination of electric and non-electric auxiliary power	G05D 16/2093
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G05D 16/2013**{using throttling means as controlling means}****Definition statement***This place covers:*

- Systems controlling the pressure using the electromagnetic valves.

Special rules of classification

Electromagnetic valves allowing only on/off operation are only classified in this group.

G05D 16/2022**{actuated by a proportional solenoid (throttling means [G05D 16/2024](#))}****Definition statement***This place covers:*

- Electromagnetic valves generating an intermediate closing force that is proportional to the current supplied.

References**Limiting references***This place does not cover:*

The throttling means being a multiple-way valve	G05D 16/2024
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G05D 16/2026**{with a plurality of throttling means}****Special rules of classification**

This group may be used in combination - with groups [G05D 16/202](#) - [G05D 16/2024](#) to describe one or more of the valves.

G05D 16/2086**{without direct action of electric energy on the controlling means (combination of electric and non-electric auxiliary [G05D 16/2093](#))}****Definition statement***This place covers:*

- Valves where the electric energy is used for an auxiliary function of an otherwise purely mechanical regulator, e.g. adjusting the set point.

References**Limiting references***This place does not cover:*

With combination of electric and non-electric auxiliary power	G05D 16/2093
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G05D 16/2093**{with combination of electric and non-electric auxiliary power}****Definition statement***This place covers:*

- Valves in which the controller pressure is compared to a reference fluid pressure generated by means of an electromagnetic pilot valve or any other means.

Special rules of classification

This group may be used in combination with subgroups [G05D 16/202](#) - [G05D 16/208](#) describing structural details of the auxiliary pilot valve.

G05D 17/00

Control of torque; Control of mechanical power

Definition statement

This place covers:

Regulation of the torque of tightening tools, control of the torque or power of electric motors, combustion engines and the like when the control is not specific of the particular drive.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Torque limiters in tools	B25B 23/14
Propulsion units in vehicles	B60K
Control of combustion engines	F02D
Control of electric motors	H02P

G05D 19/00

Control of mechanical oscillations, e.g. of amplitude, of frequency, of phase

Definition statement

This place covers:

Control of mechanical oscillations or vibrations in machines or structures, either by generating oscillations, or by damping oscillations, other than suppression of vibrations.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control devices for adjusting the frequency of portable percussion tools	B25D 9/26
Controlling means for the frequency of the jiggling movement of jiggling conveyors	B65G 27/32
Suppression of vibrations in systems	F16F 15/002
Musical instruments; acoustics	G10
Loudspeakers or like acoustic electromechanical transducers	H04R

Informative references

Attention is drawn to the following places, which may be of interest for search:

Generating or transmitting mechanical vibrations	B06B
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Control of electric motors	H02P
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G05D 21/00

Control of chemical or physico-chemical variables, e.g. pH value

Definition statement

This place covers:

Regulation of chemical composition, concentration, pH or the like in a chemical process when the regulation is not specific of the particular process.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Controlling density in sedimentation arrangements	B01D 21/32
Controlling separation of gases or vapours by gas-analysis apparatus	B01D 53/30
Control of fluid composition, e.g. gradient, of fluid carrier in chemical analysis	G01N 30/34

Informative references

Attention is drawn to the following places, which may be of interest for search:

Ratio control	G05D 11/00
Humidity control	G05D 22/00
Control of viscosity	G05D 24/00
Physical or chemical processes in general	B01J
Treatment of water	C02F

G05D 22/00

Control of humidity

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control of watering for watering gardens, fields, sports grounds or the like	A01G 25/16
Controlling humidity in poultry incubators	A01K 41/04
Control of the moisture content of tobacco products	A24B 9/00
Moistening in air treating devices of vehicles	B60H 3/02
Control arrangements for air conditioning	F24F 11/00
Controlling humidity of the gas supply in arrangements for supplying or controlling air or other gases for drying solid materials or objects	F26B 21/33

G05D 23/00

Control of temperature

Definition statement

This place covers:

Control of temperature

Further details of subgroups:

[G05D 23/022](#), [G05D 23/025](#) and [G05D 23/123](#)

These subgroups cover valves controlling the flow of a fluid as a function of the temperature of said fluid.

[G05D 23/023](#), [G05D 23/026](#) and [G05D 23/125](#)

These subgroups cover valves controlling the flow of a fluid as a function of the temperature of an external sensor, e.g. thermostat for radiator.

[G05D 23/024](#) and subgroups

These subgroups cover memory shape alloys working as a sensing element.

[G05D 23/028](#)

This subgroup covers systems where the fusing of an element irreversibly releases a cooling fluid.

[G05D 23/128](#)

This subgroup covers valves controlling the flow of fuel to a burner as a function of the temperature of a controlled space.

[G05D 23/1333](#)

This subgroup covers valves distributing the flow of a fluid among two conduits as a function of the temperature of said fluid, e.g. refrigerating systems.

[G05D 23/1353](#)

This subgroup covers not only valves where the flow is regulated, but also where it is just set by the user.

[G05D 23/185](#) and subgroups

These subgroups cover valves similar to the corresponding subgroups in [G05D 23/01](#), but further comprising the use of auxiliary pneumatic or hydraulic energy.

[G05D 23/19](#) and subgroups

In [G05D 23/19](#) documents are classified in [G05D 23/20](#), [G05D 23/22](#), [G05D 23/24](#), [G05D 23/26](#), [G05D 23/27](#), or [G05D 23/275](#) and their subgroups according to the nature of the main temperature sensor used. Additionally, documents are also classified in the CPC subgroups [G05D 23/1902](#) - [G05D 23/1951](#) relating to control features, if one or more them apply. In case the nature of the temperature sensing element is not mentioned or is irrelevant for the invention, documents are classified only in [G05D 23/19](#) or in one of more subgroups [G05D 23/1902](#) - [G05D 23/1951](#).

[G05D 23/20](#) and subgroups

Definition statement

This covers inventions where the sensing element has a variation of electric or magnetic properties other than defined in [G05D 23/22](#), [G05D 23/24](#) or [G05D 23/26](#), e.g. a semiconductor, an ionized gas or a capacitor.

[G05D 23/1902](#)

This subgroup covers inventions relating to the input means of the reference value.

[G05D 23/1904](#)

This subgroup covers systems where a temperature profile is defined as a function of time.

[G05D 23/1906](#)

This subgroup covers systems where the control action is a continuous function of the measured error.

[G05D 23/1913](#)

This subgroup covers systems delivering a series of pulses having a frequency that is a continuous function of the measured error.

[G05D 23/1919](#)

This subgroup covers systems using Peltier effect devices.

[G05D 23/1921](#)

This subgroup covers systems where the actuator consists of a heat expanding element being heated electrically in order to act on a valve.

[G05D 23/1923](#)

This subgroup covers control systems for storage heaters.

[G05D 23/1924](#)

This subgroup covers systems using solar energy.

[G05D 23/1931](#)

This subgroup covers systems measuring the temperature of the controlled space and of another space in thermal relationship with it, e.g. outdoors.

[G05D 23/1935](#)

This subgroup covers systems where one sensor is used for control after the other, e.g. measuring the input flow temperature of a heating system and later switching to measuring the output flow temperature.

References**Application-oriented references**

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Means for regulating the temperature of bakers' ovens	A21B 1/40
Devices for controlling the temperature of hair curlers	A45D 6/20
Control devices for metal extruding, e.g. for regulating temperature of metal	B21C 31/00
Temperature control means for lapping machines or devices	B24B 37/015

Devices for controlling tyre temperature	B60C 23/00
Arrangements for controlling temperature of cosmonautic vehicles	B64G 1/50
Controlling the temperature of the float baths or of the atmosphere above the float baths in glass making	C03B 18/18 , C03B 18/22
Control of temperature in the treatment of filament-forming or like material	D01D 1/09
Devices for controlling temperature of parts of knitting machines	D04B 35/30
Temperature control of hand irons	D06F 75/26
Regulating temperature of the dryer section in paper-making machines	D21F 5/06
Controlling temperature of lubricants	F01M 5/00
Controlling the supplying oil or unspecified lubricant from a reservoir by means of temperature	F16N 7/08
Controlling superheat temperature for superheating of steam	F22G 5/00
Control of central heating systems	F24D 19/10
Control of temperature in arrangements for supplying or controlling air or other gases for drying solid materials or objects	F26B 21/35
Control of temperature of fluid carrier in chemical analysis	G01N 30/30
Temperature of electric storage cells	H01M 10/60
Control of temperature in dielectric, induction or microwave heating	H05B 6/06 , H05B 6/50 , H05B 6/68
Controlling the temperature of anode of X-ray tubes	H05G 1/36

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of air-humidification systems	F24F 11/0008
Thermal management of data-processing equipment	G06F 1/206
Automatic switching arrangements for electric heating apparatus	H05B 1/02
Modifications of constructional details to facilitate cooling, ventilating, or heating of electrical apparatus	H05K 7/20

Special rules of classification

Within subgroups [G05D 23/01](#) - [G05D 23/32](#), an invention is classified in the last appropriate place in the absence of an indication of the contrary.

G05D 25/00

Control of light, e.g. intensity, colour or phase (optical devices or arrangements using movable or deformable elements for controlling light independent of the light source [G02B 26/00](#); devices or arrangements, the optical operation of which is modified by changing the optical properties of the medium of the devices or arrangements for the control of light, circuit arrangements specially adapted therefor, control of light by electro-magnetic waves, electrons or other elementary particles [G02F 1/00](#))

Definition statement

This place covers:

Regulation of intensity, colour or phase of light other than by acting on the light sources.

References

Limiting references

This place does not cover:

Optical devices or arrangements using movable or deformable elements for controlling light independent of the light source	G02B 26/00
Devices or arrangements, the optical operation of which is modified by changing the optical properties of the medium of the devices or arrangements for the control of light, circuit arrangements specially adapted therefor, control of light by electro-magnetic waves, electrons or other elementary particles	G02F 1/00

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Control devices associated with light sources in photographic composing machines	B41B 21/08
Controlling the intensity, frequency, phase, polarisation or direction of the emitted radiation of lasers	H01S 3/10
Circuit arrangements for operating electroluminescent light sources, incandescent light sources, discharge lamps, light emitting diodes, light sources using a charge of combustible material or light sources in general	H05B 39/00 - H05B 47/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Vehicle lighting	B60Q
Operating screening devices	E06B 9/68
Mechanically operable parts of lighting devices for the control of light	F21V

G05D 27/00**Simultaneous control of variables covered by two or more of main groups****G05D 1/00 - G05D 25/00****Special rules of classification**

If there is a double regulation (two independent set points for two corresponding controlled variables, e.g. temperature and humidity, when there are interactions in the control loops), the document is also classified in this group. Thus, this group should be assigned in addition to the groups corresponding to the two or more controlled variables.

G05D 29/00**Simultaneous control of electric and non-electric variables****Special rules of classification**

If there is a double regulation (two independent set points for two corresponding controlled variables, when there are interactions in the control loops), the document is also classified in this group. Thus, this group should be assigned in addition to the groups corresponding to the two or more controlled variables.

G05D 99/00**Subject matter not provided for in other groups of this subclass****Special rules of classification**

This group is not being used.

G05D 2105/10**for cleaning, vacuuming or polishing****Definition statement**

This place covers:

Vehicles designed to make a surface or a region free of dirt, marks or contaminants, especially by washing, wiping, brushing, vacuuming or polishing.

Vehicles designed for air cleaning, disinfection or sterilisation.

G05D 2105/14**{for collecting waste or trash}****Definition statement**

This place covers:

Vehicles designed to remove undesired objects from a location, e.g. removing garbage or tidying.

G05D 2105/20**for transportation****Definition statement**

This place covers:

Vehicles designed to move objects, animals or humans from one location to another in an indoor or outdoor environment.

G05D 2105/22**of humans****Definition statement**

This place covers:

Vehicles designed to transport a human as a driver or a passenger.

G05D 2105/24**{personal mobility devices}****Definition statement**

This place covers:

Motorised non-road vehicles intended for transport of a single human as a driver or a passenger, e.g. skateboards, wheelchairs or self-balancing scooters.

G05D 2105/28**of freight****Definition statement**

This place covers:

Vehicles designed to transport cargo, e.g. cargo aircraft, freight trains, lorries, delivery vehicles, forklifts or freighters.

G05D 2107/13**Spaces reserved for vehicle traffic, e.g. roads, regulated airspace or regulated waters****Definition statement**

This place covers:

Outdoor spaces reserved for vehicle traffic and regulated by a public authority.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Transportation hubs	G05D 2107/80
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G05D 2107/50**Confined spaces, e.g. tanks, pipelines, tunnels or containers****Definition statement***This place covers:*

Confined spaces not easily accessible to humans.

G05D 2109/10**Land vehicles****Definition statement***This place covers:*

Vehicles designed for moving on a solid surface, e.g. extra-terrestrial land rovers.

G05D 2109/14**{moving on a grid}****Definition statement***This place covers:*

Vehicles configured to travel along a grid of physical or visual elements, e.g. tracks or markings.

G05D 2109/15**Climbing vehicles****Definition statement***This place covers:*

Vehicles designed for climbing or moving on a substantially vertical solid surface.

G05D 2109/23**{Vertical take-off and landing [VTOL] aircraft; Short take-off and landing [STOL, STOVL] aircraft}****Definition statement***This place covers:*

Fixed wing aircraft capable of taking off and landing vertically, or of taking off from or landing on a short runway.

References**Informative references***Attention is drawn to the following places, which may be of interest for search:*

Flying platforms	G05D 2109/254
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Synonyms and Keywords

In patent documents, the following abbreviations are often used:

STOL	short take-off and landing (aircraft)
STOVL	short take-off and vertical landing (aircraft)
VTOL	vertical take-off and landing (aircraft)

G05D 2109/24

{Convertible aircraft, e.g. tiltrotor aircraft}

Definition statement

This place covers:

Aircraft having two or more separate modes of operation for generating lift, e.g. aircraft having fixed wing and rotary wing modes.

G05D 2109/25

Rotorcrafts

Definition statement

This place covers:

Aircraft generating lift from rotating blades, such as helicopters or autogyros.

G05D 2109/254

{Flying platforms, e.g. multicopters}

Definition statement

This place covers:

Aircraft having one or more rotors generating a lifting thrust, wherein attitude control is provided by differential rotor thrust control or a separate force generated outside of the rotors.

Illustrative example of subject matter classified in this place:

1a.

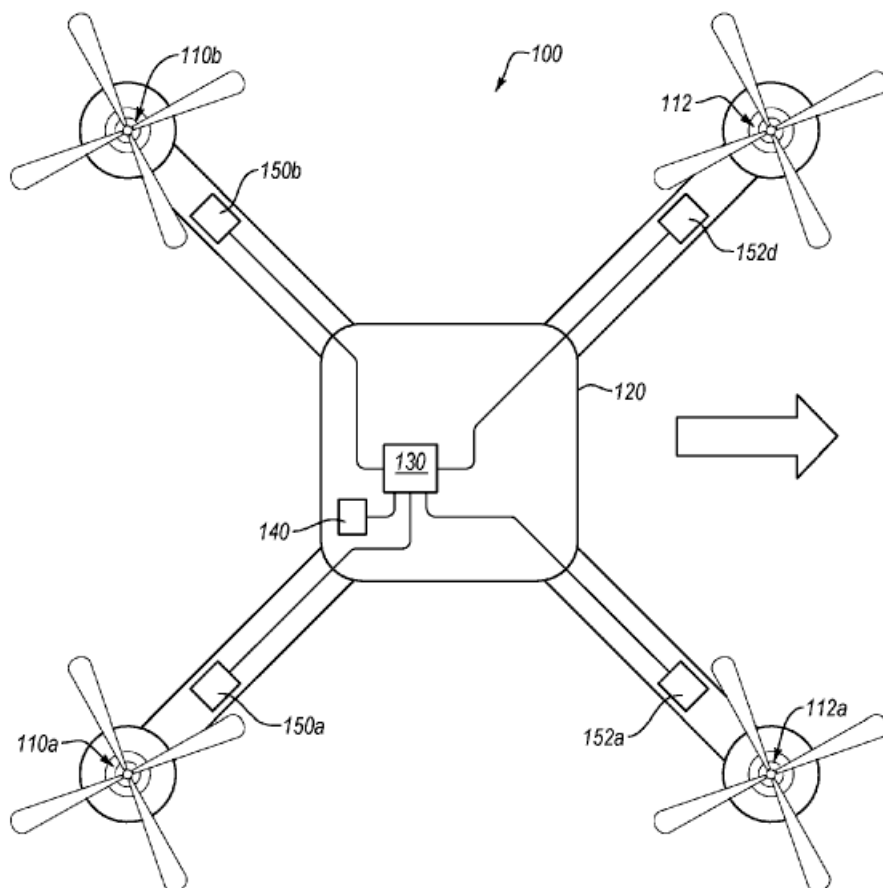


Figure 1a illustrates a top view of an aircraft having one or more rotors.

1b.

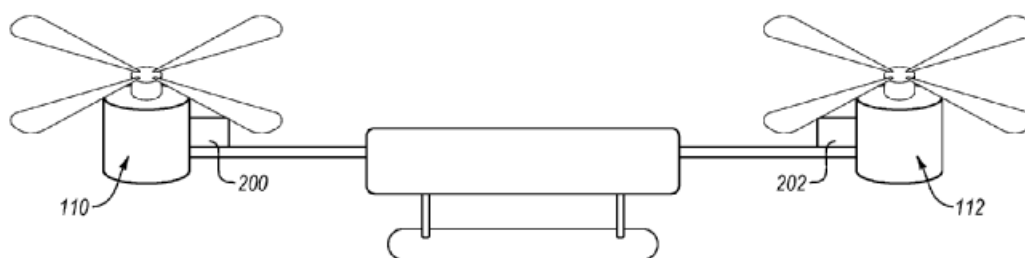


Figure 1b illustrates a side view of an aircraft having one or more rotors.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Vertical take-off and landing [VTOL] aircraft; Short take-off and landing [STOL, STOVL] aircraft	G05D 2109/23
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G05D 2109/40**Space vehicles****Definition statement**

This place covers:

Vehicles designed to operate outside of a celestial body, e.g. asteroid or planet, and its atmosphere.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Land vehicles, e.g. extra-terrestrial land rovers	G05D 2109/10
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G05D 2111/00**Details of signals used for control of position, course, altitude or attitude of land, water, air or space vehicles****Definition statement**

This place covers:

The type of signal used for determining position or orientation during control of position, course, altitude, depth or attitude of a vehicle.

References**Informative references**

Attention is drawn to the following places, which may be of interest for search:

Beacons or beacon systems transmitting signals having a characteristic or characteristics capable of being detected by non-directional receivers and defining directions, positions or position lines fixed relatively to the beacon transmitters using radio waves	G01S 1/02
Beacons or beacon systems transmitting signals having a characteristic or characteristics capable of being detected by non-directional receivers and defining directions, positions or position lines fixed relatively to the beacon transmitters using electromagnetic waves other than radio waves	G01S 1/70
Beacons or beacon systems transmitting signals having a characteristic or characteristics capable of being detected by non-directional receivers and defining directions, positions or position lines fixed relatively to the beacon transmitters using ultrasonic, sonic or infrasonic waves	G01S 1/72
Direction-finders for determining the direction from which infrasonic, sonic, ultrasonic or electromagnetic waves or particle emission, not having a directional significance, are being received using radio waves	G01S 3/02
Direction-finders for determining the direction from which infrasonic, sonic, ultrasonic or electromagnetic waves or particle emission, not having a directional significance, are being received using electromagnetic waves other than radio waves	G01S 3/78

Informative references

Direction-finders for determining the direction from which infrasonic, sonic, ultrasonic or electromagnetic waves or particle emission, not having a directional significance, are being received using ultrasonic, sonic or infrasonic waves	G01S 3/80
Position-fixing by co-ordinating two or more direction or position-line determinations or position-fixing by co-ordinating two or more distance determinations using radio waves	G01S 5/02
Position-fixing by co-ordinating two or more direction or position-line determinations or position-fixing by co-ordinating two or more distance determinations using electromagnetic waves other than radio waves	G01S 5/16
Position-fixing by co-ordinating two or more direction or position-line determinations or position-fixing by co-ordinating two or more distance determinations using ultrasonic, sonic or infrasonic waves	G01S 5/18
Systems details using the reflection or reradiation of radio waves, e.g. radar systems or analogous systems using reflection or reradiation of waves whose nature or wavelength is irrelevant or unspecified	G01S 7/02
Systems details using the reflection or reradiation of electromagnetic waves other than radio waves, e.g. lidar systems	G01S 7/48
Details of radio direction-finding, radio navigation, determining distance or velocity by use of radio waves, locating or presence-detecting by use of the reflection or reradiation of radio waves or analogous arrangements using reflection of acoustic waves	G01S 7/52
Systems for determining distance or velocity not using reflection or reradiation using radio waves	G01S 11/02
Systems for determining distance or velocity not using reflection or reradiation using electromagnetic waves other than radio waves	G01S 11/12
Systems for determining distance or velocity not using reflection or reradiation using ultrasonic, sonic or infrasonic waves	G01S 11/14
Systems using the reflection or reradiation of radio waves, e.g. radar systems or analogous systems using reflection or reradiation of waves whose nature or wavelength is irrelevant or unspecified	G01S 13/00
Systems using the reflection or reradiation of radio waves, e.g. radar systems, or analogous systems using reflection or reradiation of waves whose nature or wavelength is irrelevant or unspecified using transponders powered from received waves, e.g. using passive transponders	G01S 13/75
Radio direction-finding, radio navigation, determining distance or velocity by use of radio waves, locating or presence-detecting by use of the reflection or reradiation of radio waves or analogous arrangements using reflection of acoustic waves	G01S 15/00
Systems using the reflection or reradiation of electromagnetic waves other than radio waves, e.g. lidar systems	G01S 17/00
Satellite radio beacon positioning systems; Determining position, velocity or attitude using signals transmitted by such systems	G01S 19/00
Determining position by combining measurements of signals from the satellite radio beacon positioning system with a supplementary measurement	G01S 19/45
Determining position by combining or switching between position solutions derived from the satellite radio beacon positioning system and position solutions derived from a further system	G01S 19/48

Wireless communication networks, e.g. signals for communication purposes	H04W
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Special rules of classification

This group should only be used in combination with a corresponding group in [G05D 1/24](#) and in the case when the type of signal is used in the control of position, course, altitude, depth or attitude of a vehicle.

G05D 2111/30

Radio signals

Definition statement

This place covers:

Details of radio signals used for control of position, course, altitude or attitude of land, water, air or space vehicles.

Special rules of classification

In this place, microwave signals are considered as a type of radio signal.

G05D 2111/32

{transmitted via communication networks, e.g. cellular networks or wireless local area networks [WLAN]}

Definition statement

This place covers:

Details related to using transmission signals transmitted by communication networks to determine the position or orientation of a vehicle in order to control the position, course, altitude or attitude of the vehicle, the communication networks being originally intended for a different purpose other than position or orientation determination.

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

WLAN	wireless local area networks
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G05D 2111/65

{taken successively, e.g. visual odometry or optical flow}

Definition statement

This place covers:

Combining two or more signals of the same type generated sequentially and the combined signals being used for control of position, course, altitude or attitude of a vehicle by identifying common features in the combined signals.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of position, course, altitude or attitude of land, water, air or space vehicles including arrangements for determining position or orientation using environment maps, e.g. simultaneous localisation and mapping [SLAM]	G05D 1/246
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