

## SECTION G — PHYSICS

### G05 CONTROLLING; REGULATING

**G05D SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES** (for continuous casting of metals B22D 11/16; valves *per se* F16K; sensing non-electric variables, *see* the relevant subclasses of G01; for regulating electric or magnetic variables G05F)

#### Note(s) [7, 2006.01]

1. This subclass does not cover features of general applicability to regulating systems, e.g. anti-hunting arrangements, which are covered by subclass G05B.
2. In this subclass, the following term is used with the meaning indicated:
  - "systems" includes self-contained devices such as speed governors, pressure regulators.
3. Control systems specially adapted for particular apparatus, machines or processes are classified in the subclasses for the apparatus, machines or processes, 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"). Otherwise, classification is made in the most appropriate place in this subclass. The following are lists of places where there is specific provision of the kind referred to above. Where such provision is at a detailed level, the places have been grouped according to the main groups of 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 the title "General References".

#### Places related to

A01B 69/00.....Agricultural machines or implements  
 A63H 17/36.....Toy vehicles  
 B60V 1/11.....Air-cushion vehicles  
 B60W 30/10.....Road vehicle path control  
 B62D 1/00.....Steering controls of motor vehicles or trailers, i.e. means for initiating a change of direction  
 B62D 6/00.....Arrangements for automatically controlling the steering depending on driving conditions  
 B62D 55/116.....Chassis of endless-tracked vehicles  
 B63H 25/00.....Marine steering; control of waterborne vessels  
 B64C 13/00-B64C 15/00.....Controlling aircraft  
 B64D 25/11.....Controlling attitude or direction of aircraft ejector seats  
 B64G 1/24.....Cosmonautic vehicles  
 F41G 7/00.....Self-propelled missiles  
 F42B 15/01.....Guided missiles  
 F42B 19/01.....Marine torpedoes

#### Places related to

A43D 119/00.....Footwear manufacture  
 B21K 31/00.....Tool carriers in forging or pressing  
 B23B 39/26.....Pattern-controlled boring or drilling tools  
 B23D 1/30, B23D 3/06, B23D 5/04 Planing or slotting machines controlled by copying device  
 B23H 7/18.....Electrode to workpiece spacing in electric discharge and electrochemical machining  
 B23K 26/02.....Workpiece in laser welding or cutting  
 B23K 37/04.....Workpiece in welding  
 B23K 37/06.....Molten metal in welding  
 B23Q 5/20.....Spindles in machine tools  
 B23Q 15/00, B23Q 16/00.....Tool or work position in machine tools  
 B23Q 35/00.....Tools controlled by pattern or master model  
 B24B 17/00.....Grinding controlled by patterns, drawings, magnetic tape or the like  
 B24B 47/22.....Starting position in grinding  
 B30B 15/24.....Actuating members in presses  
 B62D 55/116.....Chassis of tracked vehicles  
 B65H 23/18.....Web-advancing mechanisms  
 E02F 3/43.....Dippers or buckets in dredgers  
 F15B 9/00.....Fluid-pressure servomotors with follow-up action  
 F24J 2/38.....Tracking of solar heat collectors  
 G03F 9/00.....Photomechanical production of patterned or textured surfaces  
 G11B 5/588.....Rotating heads in information storage systems  
 G21C 7/12.....Movement of control elements in nuclear reactors

#### Places related to

A24B 7/14.....Tobacco cutting

B05C 11/02.....Thickness of coating of fluent material on surface  
 B21B 37/16.....Thickness, width, diameter or other transverse dimensions of the products of metal-rolling mills  
 C03B 18/04.....Dimension of glass ribbon  
 D21F 7/06.....Thickness of layer in paper making

Places related to

A45D 20/26.....Air in hair drying helmets  
 A61M 5/168.....Flow of media to the human body  
 B03C 3/36.....Gases or vapour in electrostatic separators  
 B05C 11/10.....Fluent material in coating devices  
 B67D 1/12.....Dispensing beverages on draught  
 B67D 7/28.....Transferring liquids  
 C10K 1/28.....Gas purifiers  
 E21B 21/08.....Flushing boreholes  
 E21B 43/12.....Obtaining liquids from wells  
 F01D 17/00.....Flow in non-positive-displacement machines or systems  
 F01M 1/16.....Lubrication arrangements  
 F01P 7/00.....Coolant flow in cooling devices  
 F02C 9/16, F02C 9/50.....Gas-turbine working fluid  
 F16L 55/027.....Throttle passages in pipes  
 F24F 11/00.....Air-flow or supply of heating or cooling fluids in air treatment arrangements  
 F26B 21/12.....Air or gas flow in dryers  
 G01G 11/08.....Continuous flow weighing apparatus  
 G21D 3/14.....Coolant in nuclear power plant

Places related to

B01D 21/34.....Liquid level in sedimentation arrangements  
 B41L 27/04.....Ink level in printing, manifolding or duplicating arrangements  
 F22D 5/00.....Feed water for boilers  
 H01J 1/10, H01J 13/14.....Liquid pool electrodes in electric discharge tubes or lamps

Places related to

B01D 21/32.....Density in sedimentation arrangements  
 B01F 15/04.....Mixers  
 B24C 7/00.....Abrasive blasts  
 B28C 7/00.....Mixtures of clays or cements  
 B65G 53/66.....Bulk material conveyors  
 F02K 3/075.....Flow ratio in jet-propulsion plants

Places related to

B21C 1/12.....Drum speed in metal drawing  
 B23Q 15/00.....Cutting velocity of tool or work  
 B30B 15/20.....Ram speed in presses  
 B60K 31/00.....Setting or limiting speed of vehicles  
 B60L 15/00.....Electrically-propelled vehicles  
 B60W 30/14.....Road vehicle cruise control  
 B64D 31/08.....Cruising speed of aircraft  
 D01D 1/09.....Feed rate in manufacture of artificial filaments, threads, fibres, bristles or ribbons  
 D01G 15/36.....Carding machines  
 D02H 13/14.....Warping, beaming or leasing machines  
 D03D 51/16.....Cyclically varying speed of looms  
 G01N 30/32.....Speed of fluid carrier in chemical analysis  
 G11B 15/46.....Filamentary or web record carriers or heads for such carriers in information storage systems  
 G11B 19/28.....Non-filamentary, non-web record carriers, or heads for such carriers in information storage systems

Places related to

B25D 9/26.....Portable percussive tools  
 B30B 15/22.....Ram pressure in presses  
 B65H 59/00.....Tension in filamentary material  
 B65H 77/00.....Tension in webs, tapes, filamentary material  
 B66D 1/50.....Rope, cable or chain tension  
 D03D 49/04.....Tension in looms  
 D05B 47/04.....Tension in sewing machines  
 D21F 3/06.....Pressure in paper-making machines  
 F26B 13/12.....Drying fabrics  
 F26B 21/10.....Pressure in dryers  
 G11B 15/43.....Record carrier tension in information storage arrangements

Places related to

B60C 23/00.....Tyre pressure  
 B63C 11/08.....Air within diving suit  
 B64D 13/00.....Aircraft air-pressure  
 B65G 53/66.....Bulk material conveyors  
 D01D 1/09.....Manufacture of artificial filaments, threads, fibres, bristles or ribbons  
 E21B 21/08.....Flushing boreholes  
 F01M 1/16.....Lubrication arrangements  
 G01N 30/32.....Pressure of fluid carrier in chemical analysis

H01J 7/14.....Pressure in electric discharge tubes or lamps

H01K 1/52.....Pressure in electric incandescent lamps

Places related to

B25D 9/26.....Portable percussion tools

B65G 27/32.....Jigging conveyors

Places related to

B01D 21/32.....Density in sedimentation arrangements

B01D 53/30.....Treating gases or vapours

G01N 30/34.....Composition of fluid carrier in chemical analysis

Places related to

A01G 25/16.....Watering gardens, fields, sports grounds or the like

A01K 41/04.....Poultry incubators

A24B 9/00.....Tobacco products

F24F 11/00.....Air conditioning

F26B 21/08.....Dryers

Places related to

A21B 1/40.....Bakers' ovens

A45D 6/20.....Hair curlers

B21C 31/00.....Metal extruding

B60C 23/00.....Tyre temperature

B64G 1/50.....Cosmonautic vehicles

C03B 18/18, C03B 18/22.....Float baths in glass making

D01D 1/09.....Manufacture of artificial filaments, threads, fibres, bristles or ribbons

D04B 35/30.....Knitting machines

D06F 75/26.....Hand irons

D21F 5/06.....Paper-making machines

F01M 5/00.....Lubricant in lubrication arrangements

F16N 7/08.....Arrangements for supplying oil or unspecified lubricant from a reservoir

F22G 5/00.....Steam superheat

F26B 21/10.....Dryers

G01N 30/30.....Temperature of fluid carrier in chemical analysis

H01M 10/60.....Electric storage cells

H05B 6/06, H05B 6/50, H05B 6/68 Dielectric, induction or microwave heating

H05G 1/36.....Anode of X-ray tube

Places related to

B41B 21/08.....Photographic composing machines

H01S 3/10, H05B 33/08, H05B 35/00-H05B 43/00 Lasers and other light sources

General references

A01D 41/127.....Combines

A01J 5/007.....Milking machines

B23K 9/095.....Welding parameters

B23Q 35/00.....Copying

B24B 17/00, B24B 49/00.....Grinding or polishing

B24C 7/00.....Abrasive blasts

B67D 1/12.....Dispensing beverages on draught

F23C 10/28.....Combustion apparatus in which combustion takes place in a fluidised bed of fuel or other particles

G03G 21/20.....Electrographic, electrophotographic or magnetographic processes

H02P 5/00-H02P 9/00.....Dynamo-electric motors or generators

**Subclass index**

CONTROL OF: SPEED OR ACCELERATION; FORCE; PRESSURE; POWER; MECHANICAL

OSCILLATIONS.....13/00, 15/00, 16/00, 17/00, 19/00

CONTROL OF: FLOW; LEVEL; RATIO.....7/00, 9/00, 11/00

CONTROL OF: TEMPERATURE; HUMIDITY; VISCOSITY; CHEMICAL OR PHYSICO-CHEMICAL

VARIABLES; LIGHT INTENSITY.....23/00, 22/00, 24/00, 21/00, 25/00

CONTROL OF: POSITION, DIRECTION, DIMENSIONS.....1/00-5/00

SIMULTANEOUS CONTROL OF TWO OR MORE VARIABLES.....27/00, 29/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

**1/00 Control of position, course, altitude, or attitude of land, water, air, or space vehicles, e.g. automatic pilot**  
(radio navigation systems or analogous systems using other waves G01S) [1, 2006.01]

1/02 • Control of position or course in two dimensions [1, 2, 2006.01]

1/03 • • using near-field transmission systems, e.g. inductive-loop type [1, 2006.01]

1/04 • Control of altitude or depth [1, 2006.01]

1/06 • • Rate of change of altitude or depth [1, 2006.01]

1/08 • Control of attitude, i.e. control of roll, pitch, or yaw [1, 2006.01]

1/10 • Simultaneous control of position or course in three dimensions (G05D 1/12 takes precedence) [1, 2006.01]

1/12 • Target-seeking control [1, 2006.01]

3/00	<b>Control of position or direction</b> (G05D 1/00 takes precedence; for numerical control G05B 19/18) [1, 2006.01]	13/08	• without auxiliary power [1, 2006.01]
3/10	• without using feedback [3, 2006.01]	13/10	• • Centrifugal governors with fly-weights [1, 2006.01]
3/12	• using feedback [3, 2006.01]	13/12	• • • Details [1, 2006.01]
3/14	• • using an analogue comparing device [3, 2006.01]	13/14	• • • • Fly-weights; Mountings thereof; Adjusting equipment for limits, e.g. temporarily [1, 2006.01]
3/16	• • • whose output amplitude can only take a number of discrete values (G05D 3/18 takes precedence) [3, 2006.01]	13/16	• • • • Risers; Transmission gear therefor; Restoring mechanisms therefor [1, 2006.01]
3/18	• • • delivering a series of pulses [3, 2006.01]	13/18	• • • counterbalanced by spider springs acting immediately upon the fly-weights [1, 2006.01]
3/20	• • using a digital comparing device [3, 2006.01]	13/20	• • • counterbalanced by spider springs acting upon the articulated riser [1, 2006.01]
5/00	<b>Control of dimensions of material</b> [1, 2006.01]	13/22	• • • counterbalanced by fluid pressure acting upon the articulated riser [1, 2006.01]
5/02	• of thickness, e.g. of rolled material [1, 2006.01]	13/24	• • • counterbalanced by two or more different appliances acting simultaneously upon the riser, e.g. with both spring force and fluid pressure, with both spring force and electromagnetic force [1, 2006.01]
5/03	• • characterised by the use of electric means [1, 2006.01]	13/26	• • • with provision for modulating the degree of non-uniformity of speed [1, 2006.01]
5/04	• of the size of items, e.g. of particles [1, 2006.01]	13/28	• • • with provision for performing braking effects in case of increased speed [1, 2006.01]
5/06	• • characterised by the use of electric means [1, 2006.01]	13/30	• • Governors characterised by fluid features in which the speed of a shaft is converted into fluid pressure (transducers converting variations of physical quantities into fluid-pressure variations F15B 5/00) [1, 2006.01]
7/00	<b>Control of flow</b> (level control G05D 9/00; ratio control G05D 11/00; weighing apparatus G01G) [1, 2006.01]	13/32	• • • using a pump [1, 2006.01]
7/01	• without auxiliary power [1, 2006.01]	13/34	• with auxiliary non-electric power (fluid-pressure converters F15B 3/00) [1, 2, 2006.01]
7/03	• with auxiliary non-electric power [1, 2, 2006.01]	13/36	• • using regulating devices with proportional band, i.e. P. regulating devices [1, 2006.01]
7/06	• characterised by the use of electric means [1, 2006.01]	13/38	• • • involving centrifugal governors of fly-weight type [1, 2006.01]
9/00	<b>Level control, e.g. controlling quantity of material stored in vessel</b> [1, 2006.01]	13/40	• • • involving centrifugal governors of pump type [1, 2006.01]
9/02	• without auxiliary power [1, 2006.01]	13/42	• • • involving fluid governors of flow-controller type, i.e. the width of liquid flow being controlled by fly-weights [1, 2006.01]
9/04	• with auxiliary non-electric power [1, 2, 2006.01]	13/44	• • • involving fluid governors of jet type [1, 2006.01]
9/12	• characterised by the use of electric means [1, 2006.01]	13/46	• • using regulating devices with proportional band and integral action, i.e. P.I. regulating devices [1, 2006.01]
11/00	<b>Ratio control</b> (control of chemical or physico-chemical variables, e.g. pH-value, G05D 21/00; humidity control G05D 22/00; control of viscosity G05D 24/00) [1, 3, 2006.01]	13/48	• • • involving resilient restoring mechanisms [1, 2006.01]
11/02	• Controlling ratio of two or more flows of fluid or fluent material [1, 2006.01]	13/50	• • • involving connecting means for superimposing a proportional regulating device and an integral regulating device [1, 2006.01]
11/03	• • without auxiliary power [1, 2006.01]	13/52	• • using regulating devices with proportional band and derivative action, i.e. P.D. regulating devices [1, 2006.01]
11/035	• • with auxiliary non-electric power [1, 2, 2006.01]	13/54	• • • involving centrifugal governors of fly-weight type exerting an acceleratory effect [1, 2006.01]
11/04	• • • by sensing weight of individual components, e.g. gravimetric procedure [1, 2006.01]	13/56	• • • involving restoring mechanisms exerting a delay effect [1, 2006.01]
11/06	• • • by sensing density of mixture, e.g. using aerometer [1, 2006.01]	13/58	• • • involving means for connecting a speed-regulating device and an acceleration-regulating device [1, 2006.01]
11/08	• • • by sensing concentration of mixture, e.g. by measuring pH-value [1, 3, 2006.01]	13/60	• • using regulating devices with proportional band, derivative, and integral action, i.e. P.I.D. regulating devices [1, 2006.01]
11/10	• • • • by sensing moisture of non-aqueous liquids [1, 2006.01]	13/62	• characterised by the use of electric means, e.g. use of a tachometric dynamo, use of a transducer converting an electric value into a displacement [1, 2006.01]
11/12	• • • by sensing viscosity of mixture [1, 2006.01]		
11/13	• • characterised by the use of electric means [1, 2006.01]		
11/16	• Controlling mixing ratio of fluids having different temperatures, e.g. by sensing the temperature of a mixture of fluids having different viscosities [1, 2006.01]		
13/00	<b>Control of linear speed; Control of angular speed; Control of acceleration or deceleration, e.g. of a prime mover</b> (synchronising telegraph receiver and transmitter H04L 7/00) [1, 2006.01]		
13/02	• Details [1, 2006.01]		
13/04	• • providing for emergency tripping of an engine in case of exceeding maximum speed [1, 2006.01]		
13/06	• • providing for damping of erratic vibrations in governors [1, 2006.01]		

- 13/64 • Compensating the speed difference between engines meshing by a differential gearing or the speed difference between a controlling shaft and a controlled shaft [1, 2006.01]
- 13/66 • Governor units providing for co-operation with control dependent upon a variable other than speed [1, 2006.01]
- 15/00 Control of mechanical force or stress; Control of mechanical pressure [1, 2006.01]**
- 15/01 • characterised by the use of electric means [1, 2006.01]
- 16/00 Control of fluid pressure [1, 2006.01]**
- 16/02 • Modifications to reduce the effects of instability, e.g. due to vibrations, friction, abnormal temperature, overloading, unbalance (vibration-dampers F16F 7/00) [1, 2006.01]
- 16/04 • without auxiliary power [1, 2006.01]
- 16/06 • • the sensing element being a flexible member yielding to pressure, e.g. diaphragm, bellows, capsule [1, 2006.01]
- 16/08 • • • Control of liquid pressure [1, 2006.01]
- 16/10 • • the sensing element being a piston or plunger [1, 2006.01]
- 16/12 • • the sensing element being a float [1, 2006.01]
- 16/14 • with auxiliary non-electric power [1, 2, 2006.01]
- 16/16 • • derived from the controlled fluid [1, 2006.01]
- 16/18 • • derived from an external source [1, 2006.01]
- 16/20 • characterised by the use of electric means [1, 2006.01]
- 17/00 Control of torque; Control of mechanical power [1, 2006.01]**
- 17/02 • characterised by the use of electric means [1, 2006.01]
- 19/00 Control of mechanical oscillations, e.g. of amplitude, of frequency, of phase [1, 2006.01]**
- 19/02 • characterised by the use of electric means [1, 2006.01]
- 21/00 Control of chemical or physico-chemical variables, e.g. pH-value [1, 3, 2006.01]**
- 21/02 • characterised by the use of electric means [1, 2006.01]
- 22/00 Control of humidity [1, 2, 2006.01]**
- 22/02 • characterised by the use of electric means [1, 2006.01]
- 23/00 Control of temperature (automatic switching arrangements for electric heating apparatus H05B 1/02) [1, 2006.01]**
- 23/01 • without auxiliary power [1, 2006.01]
- 23/02 • • with sensing element expanding and contracting in response to changes of temperature (G05D 23/13 takes precedence) [1, 2006.01]
- 23/08 • • • with bimetallic element (arrangement of valves and flow lines specially adapted for mixing fluid F16K 11/00) [1, 2006.01]
- 23/10 • • • with snap-action elements (for valves F16K 31/56) [1, 2006.01]
- 23/12 • • with sensing element responsive to pressure or volume changes in a confined fluid [1, 2006.01]
- 23/13 • • by varying the mixing ratio of two fluids having different temperatures [1, 2006.01]
- 23/185 • with auxiliary non-electric power [1, 2, 2006.01]
- 23/19 • characterised by the use of electric means [1, 2006.01]
- 23/20 • • with sensing elements having variation of electric or magnetic properties with change of temperature (G05D 23/13 takes precedence) [1, 2006.01]
- 23/22 • • • the sensing element being a thermocouple [1, 2006.01]
- 23/24 • • • the sensing element having a resistance varying with temperature, e.g. thermistor [1, 2006.01]
- 23/26 • • • the sensing element having a permeability varying with temperature [1, 2006.01]
- 23/27 • • with sensing element responsive to radiation [1, 2006.01]
- 23/275 • • with sensing element expanding, contracting, or fusing in response to changes of temperature [1, 2006.01]
- 23/30 • • Automatic controllers with an auxiliary heating device affecting the sensing element, e.g. for anticipating change of temperature (automatic controllers in general and not restricted to control of temperature G05B) [1, 2006.01]
- 23/32 • • • with provision for adjustment of the effect of the auxiliary heating device, e.g. as a function of time [1, 2006.01]
- 24/00 Control of viscosity [1, 2006.01]**
- 24/02 • characterised by the use of electric means [1, 2006.01]
- 25/00 Control of light, e.g. intensity, colour, phase (mechanically operable parts of lighting devices for the control of light F21V; 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) [1, 4, 2006.01]**
- 25/02 • characterised by the use of electric means [1, 2006.01]
- 27/00 Simultaneous control of variables covered by two or more of main groups G05D 1/00-G05D 25/00 [1, 2006.01]**
- 27/02 • characterised by the use of electric means [1, 2006.01]
- 29/00 Simultaneous control of electric and non-electric variables [1, 2006.01]**
- 99/00 Subject matter not provided for in other groups of this subclass [2006.01]**