

CPC COOPERATIVE PATENT CLASSIFICATION

F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

ENGINEERING IN GENERAL

F15 FLUID-PRESSURE ACTUATORS; HYDRAULICS OR PNEUMATICS IN GENERAL

F15B SYSTEMS ACTING BY MEANS OF FLUIDS IN GENERAL; FLUID-PRESSURE ACTUATORS, e.g. SERVOMOTORS; DETAILS OF FLUID-PRESSURE SYSTEMS, NOT OTHERWISE PROVIDED FOR

NOTE

In this subclass, the following terms are used with the meaning stated:

- "Telemotor" means a system or device in which a substantially constant amount of fluid is trapped between an input member and an output member to act as a fluid link;
- "Servomotor" means a fluid-pressure actuator, e.g. a piston and cylinder, directly controlled by a valve or other device which is responsive to operation of an initial controlling member; "Servomotor" does not cover a telemotor. The initial controlling member may be adjacent to the servomotor or at a distance, and may be, for example a hand lever.

1/00 Installations or systems with accumulators; Supply reservoir or sump assemblies

- 1/02 . Installations or systems with accumulators
- 1/021 . . {used for damping}
- 1/022 . . {used as an emergency power source, e.g. in case of pump failure}
- 1/024 . . {used as a supplementary power source, e.g. to store energy in idle periods to balance pump load}
- 1/025 . . {used for thermal compensation, e.g. to collect expanded fluid and to return it to the system as the system fluid cools down}
- 1/027 . . having accumulator charging devices
- 1/0275 . . . {with two or more pilot valves, e.g. for independent setting of the cut-in and cut-out pressures}

WARNING

Not complete, see [F15B 1/027](#)

- 1/033 . . . with electrical control means
- 1/04 . . Accumulators
- 1/045 . . . {Dead weight accumulators}
- 1/08 . . . using a gas cushion; Gas charging devices; Indicators or floats therefor
- 1/083 {the accumulator having a fusible plug}
- 1/086 {the gas cushion being entirely enclosed by the separating means, e.g. foam or gas-filled balls}
- 1/10 with flexible separating means
- 1/103 {the separating means being bellows}
- 1/106 {characterised by the way housing components are assembled}
- 1/12 attached at their periphery ([flexible separating means in the form of a tube F15B 1/16](#))
- 1/125 {characterised by the attachment means ([F15B 1/14](#) takes precedence)}

- 1/14 by means of a rigid annular supporting member
- 1/16 in the form of a tube
- 1/165 {in the form of a bladder}
- 1/18 Anti-extrusion means
- 1/20 fixed to the separating means
- 1/22 Liquid port constructions
- 1/24 with rigid separating means, e.g. pistons
- 1/26 . Supply reservoir or sump assemblies
- 1/265 . . {with pressurised main reservoir}

3/00 Intensifiers or fluid-pressure converters, e.g. pressure exchangers; Conveying pressure from one fluid system to another, without contact between the fluids {(fluid-driven pumps F04B 9/08)}

5/00 Transducers converting variations of physical quantities, e.g. expressed by variations in positions of members, into fluid-pressure variations or vice versa; Varying fluid pressure as a function of variations of a plurality of fluid pressures or variations of other quantities ([F15B 9/00](#) takes precedence)

- 5/003 . {characterised by variation of the pressure in a nozzle or the like, e.g. nozzle-flapper system}
- 5/006 . {with electrical means, e.g. electropneumatic transducer ([F15B 5/003](#) takes precedence)}

Fluid-pressure actuator systems (systems peculiar to the control of a particular machine or apparatus covered in a single other class, see the class for such machine or apparatus)

NOTE

This heading relates to moving members into one or more definite positions by means of fluid pressure. Pump, motor and control features so far as not peculiar to this purpose are classified in the relevant classes.

7/00 Systems in which the movement produced is definitely related to the output of a volumetric pump; Telemotors

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| 7/001 | • {With multiple inputs, e.g. for dual control} | 11/028 | • . . for controlling the actuating force (F15B 11/024 takes precedence) |
| 7/003 | • {with multiple outputs} | 11/032 | • . . . by means of fluid-pressure converters |
| 7/005 | • {With rotary or crank input} | 11/0325 | • . . . {the fluid-pressure converter increasing the working force after an approach stroke} |
| 7/006 | • . {Rotary pump input} | 11/036 | • . . by means of servomotors having a plurality of working chambers |
| 7/008 | • {with rotary output} | 11/0365 | • . . . {Tandem constructions} |
| 7/02 | • Systems with continuously-operating input and output apparatus | 11/04 | • . for controlling the speed (F15B 11/024 takes precedence) |
| 7/04 | • In which the ratio between pump stroke and motor stroke varies with the resistance against the motor | 11/0406 | • . . {during starting or stopping (F15B 11/048 takes precedence)} |
| 7/06 | • Details (F15B 15/00 takes precedence) | 11/0413 | • . . {in one direction only, with no control in the reverse direction, e.g. check valve in parallel with a throttle valve} |
| 7/08 | • . Input units; Master units | 11/042 | • . . by means in the feed line {, i.e. "meter in"} (F15B 11/046 , F15B 11/05 take precedence) |
| 7/10 | • . Compensation of the liquid content in a system (F15B 7/08 takes precedence) | 11/0423 | • . . . {by controlling pump output or bypass, other than to maintain constant speed} |
| 9/00 | Servomotors with follow-up action, {e.g. obtained by feed-back control,} i.e. in which the position of the actuated member conforms with that of the controlling member | 11/0426 | • . . . {by controlling the number of pumps or parallel valves switched on} |
| 9/02 | • with servomotors of the reciprocable or oscillatable type | 11/044 | • . . by means in the return line {, i.e. "meter out"} (F15B 11/046 , F15B 11/05 take precedence) |
| 9/03 | • . with electrical control means {(F15B 9/07 , F15B 9/09 , F15B 9/17 take precedence)} | 11/0445 | • . . . {with counterbalance valves, e.g. to prevent overrunning or for braking} |
| 9/04 | • . controlled by varying the output of a pump with variable capacity | 11/046 | • . . depending on the position of the working member |
| 9/06 | • . controlled by means using a fluid jet | 11/048 | • . . . with deceleration control |
| 9/07 | • . . with electrical control means | 11/05 | • . . specially adapted to maintain constant speed, e.g. pressure-compensated, load-responsive {(F15B 11/161 takes precedence)} |
| 9/08 | • . controlled by valves affecting the fluid feed or the fluid outlet of the servomotor (F15B 9/06 takes precedence) | 11/055 | • . . . {by adjusting the pump output or bypass} |
| 9/09 | • . . with electrical control means | 11/06 | • involving features specific to the use of a compressible medium, e.g. air, steam |
| 9/10 | • . . in which the controlling element and the servomotor each controls a separate member, these members influencing different fluid passages or the same passage | 11/064 | • . with devices for saving the compressible medium |
| 9/12 | • . . in which both the controlling element and the servomotor control the same member influencing a fluid passage and are connected to that member by means of a differential gearing | 11/068 | • . with valves for gradually putting pneumatic systems under pressure |
| 9/14 | • with rotary servomotors | 11/072 | • . Combined pneumatic-hydraulic systems (F15B 11/032 takes precedence) |
| 9/16 | • Systems essentially having two or more interacting servomotors {, e.g. multi-stage (F15B 18/00 , F15B 20/00 take precedence)} | 11/0725 | • . . {with the driving energy being derived from a pneumatic system, a subsequent hydraulic system displacing or controlling the output element} |
| 9/17 | • . with electrical control means | 11/076 | • . . with pneumatic drive or displacement and speed control or stopping by hydraulic braking |
| 11/00 | Servomotor systems without provision for follow-up action; {Circuits therefor} (F15B 3/00 takes precedence) | 11/08 | • with only one servomotor |
| 11/003 | • {Systems with load-holding valves} | 11/10 | • . in which the servomotor position is a function of the pressure {also pressure regulators as operating means for such systems, the device itself may be a position indicating system} |
| 11/006 | • {Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link} | 11/12 | • . providing distinct intermediate positions; with step-by-step action |
| 11/02 | • Systems essentially incorporating special features for controlling the speed or actuating force of an output member | 11/121 | • . . {providing distinct intermediate positions (F15B 11/13 takes precedence)} |
| 11/022 | • . {in which a rapid approach stroke is followed by a slower, high-force working stroke (F15B 11/0325 takes precedence)} | 11/122 | • . . . {by means of actuators with multiple stops} |
| 11/024 | • . by means of differential connection of the servomotor lines, e.g. regenerative circuits | 11/123 | • . . . {by means of actuators with fluid-operated stops} |
| 2011/0243 | • . . {the regenerative circuit being activated or deactivated automatically} | 11/125 | • . . . {by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes} |
| 2011/0246 | • . . {with variable regeneration flow} | 11/126 | • . . . {by means of actuators of the standard type with special circuit controlling means (F15B 11/125 takes precedence)} |
| | | 11/127 | • . . {with step-by-step action} |

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| 11/128 | {by means of actuators of the standard type with special circuit controlling means} | 13/04 | . . for use with a single servomotor |
| 11/13 | . . . using {separate dosing} chambers of predetermined volume | 13/0401 | . . . {Valve members; Fluid interconnections therefor} |
| 11/15 | . . with special provision for automatic return | 13/0402 | {for linearly sliding valves, e.g. spool valves} |
| 11/16 | . With two or more servomotors | 13/0403 | {a secondary valve member sliding within the main spool, e.g. for regeneration flow (F15B 13/0418 takes precedence) } |
| 11/161 | . . {with sensing of servomotor demand or load} | 13/0405 | {for seat valves, i.e. poppet valves} |
| 11/162 | . . . {for giving priority to particular servomotors or users} | 13/0406 | {for rotary valves} |
| 11/163 | . . . {for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation} | 13/0407 | {Means for damping the valve member movement} |
| 11/165 | . . . {for adjusting the pump output or bypass in response to demand} | 2013/0409 | {Position sensing or feedback of the valve member} |
| 11/166 | . . . {Controlling a pilot pressure in response to the load, i.e. supply to at least one user is regulated by adjusting either the system pilot pressure or one or more of the individual pilot command pressures} | 2013/041 | {with two positions} |
| 11/167 | . . . {using pilot pressure to sense the demand} | 2013/0412 | {with three positions} |
| 11/168 | . . . {with an isolator valve (duplicating valve), i.e. at least one load sense [LS] pressure is derived from a work port load sense pressure but is not a work port pressure itself} | 2013/0413 | {with four or more positions} |
| 11/17 | . . using two or more pumps | 2013/0414 | {Dosing devices} |
| 11/18 | . . used in combination for obtaining stepwise operation of a single controlled member | 13/0416 | {with means or adapted for load sensing} |
| 11/183 | . . . {Linear stepwise operation} | 13/0417 | {Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves} |
| 11/186 | . . . {Rotary stepwise operation} | 13/0418 | {Load sensing elements sliding within a hollow main valve spool} |
| 11/20 | . . controlling several interacting or sequentially-operating members | 13/042 | . . . operated by fluid pressure {(F15B 13/0401, F15B 13/0416 take precedence)} |
| 11/205 | . . . {the position of the actuator controlling the fluid flow to the subsequent actuator} | 13/0422 | {with manually-operated pilot valves, e.g. joysticks} |
| 11/22 | . . Synchronisation of the movement of two or more servomotors | 13/0424 | {the joysticks being provided with electrical switches or sensors} |
| 13/00 | Details of servomotor systems {(F15B 1/04, F15B 1/26, F15B 3/00, F15B 7/08, F15B 11/02, F15B 11/10, F15B 15/00 take precedence)} ; Valves for servomotor systems} | 13/0426 | {with fluid-operated pilot valves, i.e. multiple stage valves} |
| 2013/002 | . {Modular valves, i.e. consisting of an assembly of interchangeable components} | 2013/0428 | {with switchable internal or external pilot pressure source} |
| 2013/004 | . . {Cartridge valves} | 13/043 | with electrically-controlled pilot valves |
| 2013/006 | . . {Modular components with multiple uses, e.g. kits for either normally-open or normally-closed valves, interchangeable or reprogrammable manifolds} | 13/0431 | {the electrical control resulting in an on-off function} |
| 2013/008 | . {Throttling member profiles} | 13/0433 | {the pilot valves being pressure control valves (F15B 13/0435, F15B 13/0436, F15B 13/0438 take precedence) } |
| 13/01 | . Locking-valves or other detent {i.e. load-holding} devices | 13/0435 | {the pilot valves being sliding valves} |
| 13/015 | . . {using an enclosed pilot flow valve} | 13/0436 | {the pilot valves being of the steerable jet type} |
| 13/02 | . Fluid distribution or supply devices characterised by their adaptation to the control of servomotors | 13/0438 | {the pilot valves being of the nozzle-flapper type} |
| 13/021 | . . {Valves for interconnecting the fluid chambers of an actuator} | 13/044 | . . . operated by electrically-controlled means, e.g. solenoids, torque-motors |
| 13/022 | . . {Flow-dividers; Priority valves} | 13/0442 | {with proportional solenoid allowing stable intermediate positions} |
| 13/023 | . . {Excess flow valves, e.g. for locking cylinders in case of hose burst} | 13/0444 | {with rotary electric motor} |
| 13/024 | . . {Pressure relief valves} | 13/0446 | {with moving coil, e.g. voice coil} |
| 13/025 | . . {Pressure reducing valves} | 2013/0448 | {Actuation by solenoid and permanent magnet} |
| 13/026 | . . {Pressure compensating valves} | 13/06 | . . for use with two or more servomotors |
| 13/027 | . . {Check valves} | 13/07 | . . . in distinct sequence |
| 13/028 | . . {Shuttle valves} | 13/08 | . . . Assemblies of units, each for the control of a single servomotor only |
| 13/029 | . . {Counterbalance valves} | 13/0803 | {Modular units} |
| | | 13/0807 | {Manifolds} |
| | | 13/081 | {Laminated constructions} |
| | | 13/0814 | {Monoblock manifolds} |
| | | 13/0817 | {Multiblock manifolds} |

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| 13/0821 | {Attachment or sealing of modular units to each other} | 15/088 | . . {the motor using combined actuation, e.g. electric and fluid actuation} |
| 13/0825 | {the modular elements being mounted on a common member, e.g. on a rail} | WARNING | |
| 13/0828 | {characterised by sealing means of the modular units} | Not complete, see also F15B 15/08 , F15B 2015/206 | |
| 13/0832 | {Modular valves} | 15/10 | . . the motor being of diaphragm type |
| 13/0835 | {Cartridge type valves} | 15/103 | . . . {using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators} |
| 13/0839 | {Stacked plate type valves} | 15/106 | . . . {the motor being of the pinching-roller type} |
| 13/0842 | {Monoblock type valves, e.g. with multiple valve spools in a common housing} | 15/12 | . . of the oscillating-vane or curved-cylinder type |
| 13/0846 | {Electrical details} | 15/125 | . . . {of the curved-cylinder type} |
| 13/085 | {Electrical controllers} | 15/14 | . . of the straight-cylinder type |
| 13/0853 | {Electric circuit boards} | 15/1404 | . . . {in clusters, e.g. multiple cylinders in one block} |
| 13/0857 | {Electrical connecting means, e.g. plugs, sockets} | 15/1409 | . . . {with two or more independently movable working pistons} |
| 13/086 | {Sensing means, e.g. pressure sensors} | 15/1414 | . . . {with non-rotatable piston} |
| 13/0864 | {Signalling means, e.g. LEDs} | 15/1419 | {of non-circular cross-section} |
| 13/0867 | {Data bus systems} | 15/1423 | . . . {Component parts; Constructional details} |
| 13/0871 | {Channels for fluid} | 15/1428 | {Cylinders (F15B 15/1438 takes precedence)} |
| 13/0875 | {Channels for electrical components, e.g. for cables or sensors} | 15/1433 | {End caps (F15B 15/1438 takes precedence)} |
| 13/0878 | {Assembly of modular units} | 15/1438 | {Cylinder to end cap assemblies} |
| 13/0882 | {using identical modular elements} | 15/1442 | {End cap sealings} |
| 13/0885 | {using valves combined with other components} | 15/1447 | {Pistons; Piston to piston rod assemblies} |
| 13/0889 | {Valves combined with electrical components} | 15/1452 | {Piston sealings} |
| 13/0892 | {Valves combined with fluid components} | 15/1457 | {Piston rods (F15B 15/1447 takes precedence)} |
| 13/0896 | {using different types or sizes of valves} | 15/1461 | {Piston rod sealings} |
| 13/10 | . Special arrangements for operating the actuated device {with or} without using fluid pressure, e.g. for emergency use | 15/1466 | {Hollow piston sliding over a stationary rod inside the cylinder} |
| 13/12 | . Special measures for increasing the sensitivity of the system | 15/1471 | {Guiding means other than in the end cap (F15B 15/1466 takes precedence)} |
| 13/14 | . Special measures for giving the operating person a "feeling" of the response of the actuated device | 15/1476 | {Special return means} |
| 13/16 | . Special measures for feedback {, e.g. by a follow-up device} | 15/148 | {Lost-motion means between the piston and the output} |
| 15/00 | Fluid-actuated devices for displacing a member from one position to another; Gearing associated therewith | 15/1485 | {Special measures for cooling or heating} |
| 15/02 | . Mechanical layout characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member | 15/149 | {Fluid interconnections, e.g. fluid connectors, passages} |
| 15/04 | . . with oscillating cylinder | 2015/1495 | {with screw mechanism attached to the piston} |
| 15/06 | . . for mechanically converting rectilinear movement into non- rectilinear movement | 15/16 | . . . of the telescopic type |
| 15/061 | . . . {by unidirectional means} | 15/165 | {with synchronisation of sections} |
| 15/063 | . . . {Actuator having both linear and rotary output, i.e. dual action actuator} | 15/17 | . . . of differential-piston type |
| 15/065 | . . . {the motor being of the rack-and-pinion type} | 15/18 | . Combined units comprising both motor and pump |
| 15/066 | . . . {the motor being of the scotch yoke type} | 15/19 | . Pyrotechnical actuators |
| 15/068 | . . . {the motor being of the helical type} | 15/20 | . Other details {, e.g. assembly with regulating devices} |
| 15/08 | . Characterised by the construction of the motor unit | 15/202 | . . {Externally-operated valves mounted in or on the actuator} |
| 15/082 | . . {the motor being of the slotted cylinder type} | 15/204 | . . {Control means for piston speed or actuating force without external control, e.g. control valve inside the piston (F15B 11/02 , F15B 15/22 take precedence)} |
| 15/084 | . . {the motor being of the rodless piston type, e.g. with cable, belt or chain} | 2015/206 | . . {Combined actuation, e.g. electric and fluid actuated} |
| 15/086 | . . . {with magnetic coupling} | 2015/208 | . . {Special fluid pressurisation means, e.g. thermal or electrolytic} |
| | | 15/22 | . . for accelerating or decelerating the stroke |
| | | 15/221 | . . . {for accelerating the stroke, e.g. by area increase} |

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| 15/222 | . . . {having a piston with a piston extension or piston recess which throttles the main fluid outlet as the piston approaches its end position} | 19/007 | . {Simulation or modelling} |
| 15/223 | . . . {having a piston with a piston extension or piston recess which completely seals the main fluid outlet as the piston approaches its end position} | 20/00 | Safety arrangements for fluid actuator systems; Applications of safety devices in fluid actuator systems; Emergency measures for fluid actuator systems |
| 15/224 | . . . {having a piston which closes off fluid outlets in the cylinder bore by its own movement} | 20/001 | . {Double valve requiring the use of both hands simultaneously} |
| 15/225 | . . . {with valve stems operated by contact with the piston end face or with the cylinder wall} | 20/002 | . {Electrical failure} |
| 15/226 | . . . {having elastic elements, e.g. springs, rubber pads} | 20/004 | . {Fluid pressure supply failure} |
| 15/227 | . . . {having an auxiliary cushioning piston within the main piston or the cylinder end face} | 20/005 | . {Leakage; Spillage; Hose burst} |
| 15/228 | . . . {having shock absorbers mounted outside the actuator housing} | 20/007 | . {Overload} |
| 15/24 | . . for restricting the stroke | 20/008 | . {Valve failure} |
| 15/26 | . . Locking mechanisms | 21/00 | Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass |
| 15/261 | . . . {using positive interengagement, e.g. balls and grooves, for locking in the end positions} | 21/001 | . {Servomotor systems with fluidic control} |
| 15/262 | . . . {using friction, e.g. brake pads} | 21/003 | . {Systems with different interchangeable components, e.g. using preassembled kits} |
| 15/264 | {Screw mechanisms attached to the piston} | 21/005 | . {Filling or draining of fluid systems} |
| 15/265 | . . . {specially adapted for rodless pistons or slotted cylinders} | 21/006 | . {Compensation or avoidance of ambient pressure variation} |
| 2015/267 | . . . {Manual locking or release} | 21/008 | . {Reduction of noise or vibration} |
| 2015/268 | . . . {Fluid supply for locking or release independent of actuator pressurisation} | 21/02 | . Servomotor systems with programme control derived from a store or timing device; Control devices therefor |
| 15/28 | . . Means for indicating the position, e.g. end of stroke | 21/04 | . Special measures taken in connection with the properties of the fluid |
| 15/2807 | . . . {Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches} | 21/041 | . . {Removal or measurement of solid or liquid contamination, e.g. filtering} |
| 15/2815 | . . . {Position sensing, i.e. means for continuous measurement of position, e.g. LVDT} | 21/042 | . . {Controlling the temperature of the fluid} |
| 15/2823 | {by a screw mechanism attached to the piston} | <u>WARNING</u> | |
| 15/283 | {using a cable wrapped on a drum and attached to the piston} | | Group F15B 21/042 is impacted by reclassification into groups F15B 21/0423 and F15B 21/0427 . |
| 15/2838 | {with out using position sensors, e.g. by volume flow measurement or pump speed} | | Groups F15B 21/042 , F15B 21/0423 , and F15B 21/0427 should be considered in order to perform a complete search. |
| 15/2846 | {using detection of markings, e.g. markings on the piston rod} | 21/0423 | . . . {Cooling} |
| 15/2853 | {using potentiometers} | <u>WARNING</u> | |
| 15/2861 | {using magnetic means} | | Group F15B 21/0423 is incomplete pending reclassification of documents from group F15B 21/042 . |
| 15/2869 | {using electromagnetic radiation, e.g. radar or microwaves} | | Groups F15B 21/042 and F15B 21/0423 should be considered in order to perform a complete search. |
| 15/2876 | {using optical means, e.g. laser} | | |
| 15/2884 | {using sound, e.g. ultrasound} | | |
| 15/2892 | . . . {characterised by the attachment means} | | |
| 17/00 | Combinations of telemotor and servomotor systems | 21/0427 | . . . {Heating} |
| 17/02 | . in which a telemotor operates the control member of a servomotor | <u>WARNING</u> | |
| 18/00 | Parallel arrangements of independent servomotor systems | | Group F15B 21/0427 is incomplete pending reclassification of documents from group F15B 21/042 . |
| 19/00 | Testing; {Calibrating; Fault detection or monitoring; Simulation or modelling of} fluid-pressure systems or apparatus not otherwise provided for | | Groups F15B 21/042 and F15B 21/0427 should be considered in order to perform a complete search. |
| 19/002 | . {Calibrating} | 21/044 | . . {Removal or measurement of undissolved gas, e.g. de-aeration, venting or bleeding} |
| 19/005 | . {Fault detection or monitoring} | 21/045 | . . {Compensating for variations in viscosity or temperature} |
| | | 21/047 | . . {Preventing foaming, churning or cavitation} |

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| 21/048 | . . {Arrangements for compressed air preparation, e.g. comprising air driers, air condensers, filters, lubricators or pressure regulators} | 2201/51 | . . Pressure detection |
| 21/06 | . Use of special fluids, e.g. liquid metal; Special adaptations of fluid-pressure systems, or control of elements therefor, to the use of such fluids | 2201/515 | . . Position detection for separating means |
| 21/065 | . . {Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid} | 2201/60 | . Assembling or methods for making accumulators |
| 21/08 | . Servomotor systems incorporating electrically operated control means (F15B 21/02, {F15B 21/065} take precedence) | 2201/605 | . . Assembling or methods for making housings therefor |
| 21/082 | . . {with different modes} | 2201/61 | . . Assembling or methods for making separating means therefor |
| 21/085 | . . {using a data bus, e.g. "CANBUS"} | 2201/615 | . . Assembling or methods for making ports therefor |
| 21/087 | . . {Control strategy, e.g. with block diagram} | 2211/00 | Circuits for servomotor systems |
| 21/10 | . Delay devices or arrangements | 2211/20 | . Fluid pressure source, e.g. accumulator or variable axial piston pump |
| 21/12 | . Fluid oscillators or pulse generators | 2211/205 | . . Systems with pumps |
| 21/125 | . . {by means of a rotating valve} | 2211/20507 | . . . Type of prime mover |
| 21/14 | . Energy-recuperation means | 2211/20515 | Electric motor |
| 2201/00 | Accumulators | 2211/20523 | Internal combustion engine |
| 2201/20 | . Accumulator cushioning means | 2211/2053 | . . . Type of pump |
| 2201/205 | . . using gas | 2211/20538 | constant capacity |
| 2201/21 | . . using springs | 2211/20546 | variable capacity |
| 2201/215 | . . using weights | 2211/20553 | with pilot circuit, e.g. for controlling a swash plate |
| 2201/22 | . . using elastic housings | 2211/20561 | reversible |
| 2201/30 | . Accumulator separating means | 2211/20569 | capable of working as pump and motor |
| 2201/305 | . . without separating means | 2211/20576 | . . . with multiple pumps |
| 2201/31 | . . having rigid separating means, e.g. pistons | 2211/20584 | Combinations of pumps with high and low capacity |
| 2201/312 | . . . Sealings therefor, e.g. piston rings | 2211/20592 | Combinations of pumps for supplying high and low pressure |
| 2201/315 | . . having flexible separating means | 2211/21 | . . Systems with pressure sources other than pumps, e.g. with a pyrotechnical charge |
| 2201/3151 | . . . the flexible separating means being diaphragms or membranes | 2211/212 | . . . the pressure sources being accumulators |
| 2201/3152 | . . . the flexible separating means being bladders | 2211/214 | . . . the pressure sources being hydrotransformers |
| 2201/3153 | . . . the flexible separating means being bellows | 2211/216 | . . . the pressure sources being pneumatic-to-hydraulic converters |
| 2201/3154 | . . . the flexible separating means being completely enclosed, e.g. using gas-filled balls or foam | 2211/218 | . . . the pressure sources being pyrotechnical charges |
| 2201/3155 | . . . characterised by the material of the flexible separating means | 2211/25 | . . Pressure control functions |
| 2201/3156 | . . . characterised by their attachment | 2211/251 | . . . High pressure control |
| 2201/3157 | . . . Sealings for the flexible separating means | 2211/252 | . . . Low pressure control |
| 2201/3158 | . . . Guides for the flexible separating means, e.g. for a collapsed bladder | 2211/253 | . . . Pressure margin control, e.g. pump pressure in relation to load pressure |
| 2201/32 | . . having multiple separating means, e.g. with an auxiliary piston sliding within a main piston, multiple membranes or combinations thereof | 2211/255 | . . Flow control functions |
| 2201/40 | . Constructional details of accumulators not otherwise provided for | 2211/26 | . . Power control functions |
| 2201/405 | . . Housings | 2211/265 | . . Control of multiple pressure sources |
| 2201/4053 | . . . characterised by the material | 2211/2652 | . . . without priority |
| 2201/4056 | . . . characterised by the attachment of housing components | 2211/2654 | . . . one or more pressure sources having priority |
| 2201/41 | . . Liquid ports | 2211/2656 | . . . by control of the pumps |
| 2201/411 | . . . having valve means | 2211/2658 | . . . by control of the prime movers |
| 2201/413 | . . . having multiple liquid ports | 2211/27 | . . Directional control by means of the pressure source |
| 2201/415 | . . Gas ports | 2211/275 | . . Control of the prime mover, e.g. hydraulic control |
| 2201/4155 | . . . having valve means | 2211/30 | . Directional control |
| 2201/42 | . . Heat recuperators for isothermal compression and expansion | 2211/305 | . . characterised by the type of valves |
| 2201/43 | . . Anti-extrusion means | 2211/30505 | . . . Non-return valves, i.e. check valves |
| 2201/435 | . . . being fixed to the separating means | 2211/3051 | Cross-check valves |
| 2201/50 | . Monitoring, detection and testing means for accumulators | 2211/30515 | Load holding valves |
| 2201/505 | . . Testing of accumulators, e.g. for testing tightness | 2211/3052 | . . . Shuttle valves |
| | | 2211/30525 | . . . Directional control valves, e.g. 4/3-directional control valve |
| | | 2211/3053 | In combination with a pressure compensating valve |

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| 2211/30535 | | the pressure compensating valve is arranged between pressure source and directional control valve | 2211/31523 | . . . | being connected to a pressure source and an output member |
| 2211/3054 | | the pressure compensating valve is arranged between directional control valve and output member | 2211/31529 | | having a single pressure source and a single output member |
| 2211/30545 | | the pressure compensating valve is arranged between output member and directional control valve | 2211/31535 | | having multiple pressure sources and a single output member |
| 2211/3055 | | the pressure compensating valve is arranged between directional control valve and return line | 2211/31541 | | having a single pressure source and multiple output members |
| 2211/30555 | | Inlet and outlet of the pressure compensating valve being connected to the directional control valve | 2211/31547 | | having multiple pressure sources and multiple output members |
| 2211/3056 | . . . | Assemblies of multiple valves | 2211/31552 | . . . | being connected to an output member and a return line |
| 2211/30565 | | having multiple valves for a single output member, e.g. for creating higher valve function by use of multiple valves like two 2/2-valves replacing a 5/3-valve | 2211/31558 | | having a single output member |
| 2211/3057 | | having two valves, one for each port of a double-acting output member | 2211/31564 | | having multiple output members |
| 2211/30575 | | in a Wheatstone Bridge arrangement (also half bridges) | 2211/3157 | . . . | being connected to a pressure source, an output member and a return line |
| 2211/3058 | | having additional valves for interconnecting the fluid chambers of a double-acting actuator, e.g. for regeneration mode or for floating mode (directional control valves having a regenerative position F15B 2211/3133 ; directional control valves having a floating position F15B 2211/3127) | 2211/31576 | | having a single pressure source and a single output member |
| 2211/30585 | | having a single valve for multiple output members | 2211/31582 | | having multiple pressure sources and a single output member |
| 2211/3059 | | having multiple valves for multiple output members | 2211/31588 | | having a single pressure source and multiple output members |
| 2211/30595 | | with additional valves between the groups of valves for multiple output members | 2211/31594 | | having multiple pressure sources and multiple output members |
| 2211/31 | . . | characterised by the positions of the valve element | 2211/32 | . . | characterised by the type of actuation |
| 2211/3105 | . . . | Neutral or centre positions | 2211/321 | . . . | mechanically |
| 2211/3111 | | the pump port being closed in the centre position, e.g. so-called closed centre | 2211/322 | | actuated by biasing means, e.g. spring-actuated |
| 2211/3116 | | the pump port being open in the centre position, e.g. so-called open centre | 2211/323 | | the biasing means being adjustable |
| 2211/3122 | . . . | Special positions other than the pump port being connected to working ports or the working ports being connected to the return line | 2211/324 | | manually, e.g. by using a lever or pedal |
| 2211/3127 | | Floating position connecting the working ports and the return line | 2211/325 | | actuated by an output member of the circuit |
| 2211/3133 | | Regenerative position connecting the working ports or connecting the working ports to the pump, e.g. for high-speed approach stroke | 2211/326 | | with follow-up action |
| 2211/3138 | . . . | the positions being discrete | 2211/327 | . . . | electrically or electronically |
| 2211/3144 | . . . | the positions being continuously variable, e.g. as realised by proportional valves | 2211/328 | | with signal modulation, e.g. pulse width modulation [PWM] |
| 2211/315 | . . | characterised by the connections of the valve or valves in the circuit | 2211/329 | . . . | actuated by fluid pressure |
| 2211/31505 | . . . | being connected to a pressure source and a return line | 2211/35 | . . | Directional control combined with flow control |
| 2211/31511 | | having a single pressure source | 2211/351 | . . . | Flow control by regulating means in feed line, i.e. meter-in control |
| 2211/31517 | | having multiple pressure sources | 2211/353 | . . . | Flow control by regulating means in return line, i.e. meter-out control |
| | | | 2211/355 | . . | Pilot pressure control |
| | | | 2211/36 | . . | Pilot pressure sensing |
| | | | 2211/365 | . . | Directional control combined with flow control and pressure control |
| | | | 2211/40 | . . | Flow control |
| | | | 2211/405 | . . | characterised by the type of flow control means or valve |
| | | | 2211/40507 | . . . | with constant throttles or orifices |
| | | | 2211/40515 | . . . | with variable throttles or orifices |
| | | | 2211/40523 | . . . | with flow dividers |
| | | | 2211/4053 | | using valves |
| | | | 2211/40538 | | using volumetric pumps or motors |
| | | | 2211/40546 | . . . | with flow combiners |
| | | | 2211/40553 | . . . | with pressure compensating valves |
| | | | 2211/40561 | | the pressure compensating valve arranged upstream of the flow control means |
| | | | 2211/40569 | | the pressure compensating valve arranged downstream of the flow control means |
| | | | 2211/40576 | . . . | Assemblies of multiple valves |
| | | | 2211/40584 | | the flow control means arranged in parallel with a check valve |
| | | | 2211/40592 | | with multiple valves in parallel flow paths, |

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| 2211/41 | . . characterised by the positions of the valve element | 2211/50572 | using a pressure compensating valve for controlling the pressure difference across a flow control valve |
| 2211/411 | . . . the positions being discrete | 2211/50581 | using counterbalance valves |
| 2211/413 | . . . the positions being continuously variable, e.g. as realised by proportional valves | 2211/5059 | using double counterbalance valves |
| 2211/415 | . . characterised by the connections of the flow control means in the circuit | 2211/51 | . . characterised by the positions of the valve element |
| 2211/41509 | . . . being connected to a pressure source and a directional control valve | 2211/511 | . . . the positions being discrete |
| 2211/41518 | being connected to multiple pressure sources | 2211/513 | . . . the positions being continuously variable, e.g. as realised by proportional valves |
| 2211/41527 | . . . being connected to an output member and a directional control valve | 2211/515 | . . characterised by the connections of the pressure control means in the circuit |
| 2211/41536 | being connected to multiple ports of an output member | 2211/5151 | . . . being connected to a pressure source and a directional control valve |
| 2211/41545 | being connected to multiple output members | 2211/5152 | being connected to multiple pressure sources |
| 2211/41554 | . . . being connected to a return line and a directional control valve | 2211/5153 | . . . being connected to an output member and a directional control valve |
| 2211/41563 | . . . being connected to a pressure source and a return line | 2211/5154 | being connected to multiple ports of an output member |
| 2211/41572 | . . . being connected to a pressure source and an output member | 2211/5155 | being connected to multiple output members |
| 2211/41581 | . . . being connected to an output member and a return line | 2211/5156 | . . . being connected to a return line and a directional control valve |
| 2211/4159 | . . . being connected to a pressure source, an output member and a return line | 2211/5157 | . . . being connected to a pressure source and a return line |
| 2211/42 | . . characterised by the type of actuation | 2211/5158 | . . . being connected to a pressure source and an output member |
| 2211/421 | . . . mechanically | 2211/5159 | . . . being connected to an output member and a return line |
| 2211/422 | actuated by biasing means, e.g. spring-actuated | 2211/52 | . . characterised by the type of actuation |
| 2211/423 | manually, e.g. by using a lever or pedal | 2211/521 | . . . mechanically |
| 2211/424 | actuated by an output member of the circuit | 2211/522 | actuated by biasing means, e.g. spring-actuated |
| 2211/425 | with follow-up action | 2211/523 | manually, e.g. by using a lever or pedal |
| 2211/426 | . . . electrically or electronically | 2211/524 | actuated by an output member of the circuit |
| 2211/427 | with signal modulation, e.g. using pulse width modulation [PWM] | 2211/525 | with follow-up action |
| 2211/428 | . . . actuated by fluid pressure | 2211/526 | . . . electrically or electronically |
| 2211/45 | . . Control of bleed-off flow, e.g. control of bypass flow to the return line | 2211/527 | with signal modulation, e.g. pulse width modulation [PWM] |
| 2211/455 | . . Control of flow in the feed line, i.e. meter-in control | 2211/528 | . . . actuated by fluid pressure |
| 2211/46 | . . Control of flow in the return line, i.e. meter-out control | 2211/55 | . . for limiting a pressure up to a maximum pressure, e.g. by using a pressure relief valve |
| 2211/465 | . . Flow control with pressure compensation | 2211/555 | . . for assuring a minimum pressure, e.g. by using a back pressure valve |
| 2211/47 | . . Flow control in one direction only | 2211/56 | . . Control of an upstream pressure |
| 2211/473 | . . . without restriction in the reverse direction | 2211/565 | . . Control of a downstream pressure |
| 2211/476 | . . . the flow in the reverse direction being blocked | 2211/57 | . . Control of a differential pressure |
| 2211/50 | . Pressure control | 2211/575 | . . Pilot pressure control |
| 2211/505 | . . characterised by the type of pressure control means | 2211/5753 | . . . for closing a valve |
| 2211/50509 | . . . the pressure control means controlling a pressure upstream of the pressure control means | 2211/5756 | . . . for opening a valve |
| 2211/50518 | using pressure relief valves | 2211/60 | . Circuit components or control therefor |
| 2211/50527 | using cross-pressure relief valves | 2211/605 | . . Load sensing circuits |
| 2211/50536 | using unloading valves controlling the supply pressure by diverting fluid to the return line | 2211/6051 | . . . having valve means between output member and the load sensing circuit |
| 2211/50545 | using braking valves to maintain a back pressure | 2211/6052 | using check valves |
| 2211/50554 | . . . the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve | 2211/6054 | using shuttle valves |
| 2211/50563 | . . . the pressure control means controlling a differential pressure | 2211/6055 | using pressure relief valves |
| | | 2211/6057 | using directional control valves |
| | | 2211/6058 | . . . with isolator valves |
| | | 2211/61 | . . Secondary circuits |
| | | 2211/611 | . . . Diverting circuits, e.g. for cooling or filtering |
| | | 2211/613 | . . . Feeding circuits |
| | | 2211/615 | . . Filtering means |
| | | 2211/62 | . . Cooling or heating means |

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| 2211/625 | . . Accumulators | 2211/7055 | having more than two chambers |
| 2211/63 | . . Electronic controllers | 2211/7056 | Tandem cylinders |
| 2211/6303 | . . . using input signals | 2211/7057 | being of the telescopic type |
| 2211/6306 | representing a pressure | 2211/7058 | . . . Rotary output members |
| 2211/6309 | the pressure being a pressure source supply pressure | 2211/71 | . . Multiple output members, e.g. multiple hydraulic motors or cylinders |
| 2211/6313 | the pressure being a load pressure | 2211/7107 | . . . the output members being mechanically linked |
| 2211/6316 | the pressure being a pilot pressure | 2211/7114 | . . . with direct connection between the chambers of different actuators |
| 2211/632 | representing a flow rate | 2211/7121 | the chambers being connected in series |
| 2211/6323 | the flow rate being a pressure source flow rate | 2211/7128 | the chambers being connected in parallel |
| 2211/6326 | the flow rate being an output member flow rate | 2211/7135 | . . . Combinations of output members of different types, e.g. single-acting cylinders with rotary motors |
| 2211/633 | representing a state of the prime mover, e.g. torque or rotational speed | 2211/7142 | . . . the output members being arranged in multiple groups |
| 2211/6333 | representing a state of the pressure source, e.g. swash plate angle | 2211/715 | . . having braking means |
| 2211/6336 | representing a state of the output member, e.g. position, speed or acceleration | 2211/72 | . . having locking means |
| 2211/634 | representing a state of a valve | 2211/75 | . . Control of speed of the output member |
| 2211/6343 | representing a temperature | 2211/755 | . . Control of acceleration or deceleration of the output member |
| 2211/6346 | representing a state of input means, e.g. joystick position | 2211/76 | . . Control of force or torque of the output member |
| 2211/635 | . . Circuits providing pilot pressure to pilot pressure-controlled fluid circuit elements | 2211/761 | . . . Control of a negative load, i.e. of a load generating hydraulic energy |
| 2211/6355 | . . . having valve means | 2211/763 | . . . Control of torque of the output member by means of a variable capacity motor, i.e. by a secondary control on the motor |
| 2211/65 | . . Methods of control of the load sensing pressure | 2211/765 | . . Control of position or angle of the output member |
| 2211/651 | . . . characterised by the way the load pressure is communicated to the load sensing circuit | 2211/7653 | . . . at distinct positions, e.g. at the end position |
| 2211/652 | . . . the load sensing pressure being different from the load pressure | 2211/7656 | . . . with continuous position control |
| 2211/653 | . . . the load sensing pressure being higher than the load pressure | 2211/77 | . . Control of direction of movement of the output member |
| 2211/654 | . . . the load sensing pressure being lower than the load pressure | 2211/7708 | . . . in one direction only |
| 2211/655 | . . Methods of contamination control, i.e. methods of control of the cleanliness of circuit components or of the pressure fluid | 2211/7716 | . . . with automatic return |
| 2211/66 | . . Temperature control methods | 2211/7725 | . . . with automatic reciprocation |
| 2211/665 | . . Methods of control using electronic components | 2211/7733 | . . . providing vibrating movement, e.g. dither control for emptying a bucket |
| 2211/6651 | . . . Control of the prime mover, e.g. control of the output torque or rotational speed | 2211/7741 | . . . with floating mode, e.g. using a direct connection between both lines of a double-acting cylinder |
| 2211/6652 | . . . Control of the pressure source, e.g. control of the swash plate angle | 2211/775 | . . Combined control, e.g. control of speed and force for providing a high speed approach stroke with low force followed by a low speed working stroke with high force, e.g. for a hydraulic press |
| 2211/6653 | . . . Pressure control | 2211/78 | . . Control of multiple output members |
| 2211/6654 | . . . Flow rate control | 2211/781 | . . . one or more output members having priority |
| 2211/6655 | . . . Power control, e.g. combined pressure and flow rate control | 2211/782 | . . . Concurrent control, e.g. synchronisation of two or more actuators |
| 2211/6656 | . . . Closed loop control, i.e. control using feedback | 2211/783 | . . . Sequential control |
| 2211/6657 | . . . Open loop control, i.e. control without feedback | 2211/785 | . . Compensation of the difference in flow rate in closed fluid circuits using differential actuators |
| 2211/6658 | . . . Control using different modes, e.g. four-quadrant-operation, working mode and transportation mode | 2211/80 | . Other types of control related to particular problems or conditions |
| 2211/67 | . . Methods for controlling pilot pressure | 2211/85 | . . Control during special operating conditions |
| 2211/70 | . Output members, e.g. hydraulic motors or cylinders or control therefor | 2211/851 | . . . during starting |
| 2211/705 | . . characterised by the type of output members or actuators | 2211/853 | . . . during stopping |
| 2211/7051 | . . . Linear output members | 2211/855 | . . Testing of fluid pressure systems |
| 2211/7052 | Single-acting output members | 2211/857 | . . Monitoring of fluid pressure systems |
| 2211/7053 | Double-acting output members | 2211/86 | . . Control during or prevention of abnormal conditions |
| 2211/7054 | Having equal piston areas | 2211/8603 | . . . the abnormal condition being an obstacle |
| | | 2211/8606 | . . . the abnormal condition being a shock |
| | | 2211/8609 | . . . the abnormal condition being cavitation |

- 2211/8613 . . . the abnormal condition being oscillations
- 2211/8616 . . . the abnormal condition being noise or vibration
- 2211/862 . . . the abnormal condition being electric or electronic failure
- 2211/8623 Electric supply failure
- 2211/8626 Electronic controller failure, e.g. software, EMV, electromagnetic interference
- 2211/863 . . . the abnormal condition being a hydraulic or pneumatic failure
- 2211/8633 Pressure source supply failure
- 2211/8636 Circuit failure, e.g. valve or hose failure
- 2211/864 Failure of an output member, e.g. actuator or motor failure
- 2211/8643 . . . the abnormal condition being a human failure
- 2211/8646 . . . the abnormal condition being hysteresis
- 2211/865 . . Prevention of failures
- 2211/87 . . Detection of failures
- 2211/875 . . Control measures for coping with failures
- 2211/8752 . . . Emergency operation mode, e.g. fail-safe operation mode
- 2211/8755 . . . Emergency shut-down
- 2211/8757 . . . using redundant components or assemblies
- 2211/88 . . Control measures for saving energy
- 2211/885 . . Control specific to the type of fluid, e.g. specific to magnetorheological fluid
- 2211/8855 . . . Compressible fluids, e.g. specific to pneumatics
- 2211/89 . . Control specific for achieving vacuum or "negative pressure"
- 2211/895 . . Manual override
- 2215/00 Fluid-actuated devices for displacing a member from one position to another**
- 2215/30 . . Constructional details thereof
- 2215/305 . . characterised by the use of special materials