# CPC COOPERATIVE PATENT CLASSIFICATION

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

({ hydraulically or pneumatically operated lifting devices for soil-working machines A01B 63/10 ; hydraulic drawing presses B21D; hydraulic or pneumatic manipulators B25J; hydraulic or pneumatic tipping devices for vehicles B60P 1/00 ; hydraulic or pneumatic remote control for railway signals B61L 7/04 ; hydraulic or pneumatic mine supports E21D 15/44 }; motors, turbines, compressors, blowers, pumps F01 to F04;{fluid signal amplifiers, relays F15C} ; fluid dynamics F15D; fluid clutches or brakes F16D; fluid springs F16F; fluid gearing F16H; pistons, cylinders packing F16J; valves, taps, cocks, actuating-floats F16K; safety valves with auxiliary fluid operation of the main valve F16K 17/10 ; fluid-operating means for valves F16K 31/12 ; pipes, pipe joints F16L; lubricating F16N)

**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.

### F15B 1/00 Installations or systems with accumulators; Supply reservoir or sump assemblies

F15B 1/02 . Installations or systems with accumulators ({ energy recuperation means F15B 21/14 } ; devices damping pulsations or vibrations for fluids for use in, or connection with, pipes or pipe systems F16L 55/04)

F15B 1/021 . . {used for damping}

F15B 1/022 . . {used as an emergency power source, e.g. in case of pump failure}

F15B 1/024 . . {used as a supplementary power source, e.g. to store energy in idle periods to balance pump load}

F15B 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}

F15B 1/027 . . having accumulator charging devices (control of fluid pressure in general G05D 16/00)

F15B 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

F15B 1/033 . . . with electrical control means

F15B 1/04 . . Accumulators (connection of valves to inflatable elastic bodies B60C 29/00)

F15B 1/045 . . . {Dead weight accumulators}

F15B 1/08 . . . using a gas cushion; Gas charging devices; Indicators or floats therefor

F15B 1/083 . . . . {the accumulator having a fusible plug}

F15B 1/086 . . . . {the gas cushion being entirely enclosed by the separating means, e.g. foam or gas-filled balls}

F15B 1/10 . . . . with flexible separating means

F15B 1/103 . . . . . {the separating means being bellows}

F15B 1/106 . . . . . {characterised by the way housing components are assembled}

F15B 1/12 . . . . . attached at their periphery (F15B 1/16 takes precedence)

F15B 1/125 . . . . . {characterised by the attachment means (F15B 1/14 takes precedence)}

F15B 1/14 . . . . . by means of a rigid annular supporting member

F15B 1/16 . . . . . in the form of a tube

F15B 1/165 . . . . . {in the form of a bladder}

F15B 1/18 . . . . . Anti-extrusion means

F15B 1/20 . . . . . fixed to the separating means

F15B 1/22 . . . . Liquid port constructions

F15B 1/24 . . . . with rigid separating means, e.g. pistons

F15B 1/26 . Supply reservoir or sump assemblies

F15B 1/265 . . {with pressurised main reservoir (systems with accumulators F15B 1/02)}

**F15B 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)**}**

**F15B 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; for measuring or controlling G01 , G05)

F15B 5/003 . {characterised by variation of the pressure in a nozzle or the like, e.g. nozzle-flapper system}

F15B 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.

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| **F15B 7/00** | **Systems in which the movement produced is definitely related to the output of a volumetric pump; Telemotors {**(for control in motor vehicles B60K ; in ships B63H 25/00 ; in aircraft B64C 13/00 ; combinations of telemotor and servomotor systems F15B 17/00)**}** |
| F15B 7/001 | . {with multiple inputs (input units F15B 7/08 , e.g. for dual control)} |
| F15B 7/003 | . {with multiple outputs} |
| F15B 7/005 | . {with rotary or crank input (input units F15B 7/08)} |
| F15B 7/006 | . . {Rotary pump input} |
| F15B 7/008 | . {with rotary output} |
| F15B 7/02 | . Systems with continuously-operating input and output apparatus |
| F15B 7/04 | . in which the ratio between pump stroke and motor stroke varies with the resistance against the motor (in brake-actuating systems for motor vehicles B60T) |
| F15B 7/06 | . Details (F15B 15/00 takes precedence) |
| F15B 7/08 | . . Input units; Master units |
| F15B 7/10 | . . Compensation of the liquid content in a system (F15B 7/08 takes precedence; pressure-maintaining arrangements for brake master cylinders B60T 11/228) |
| **F15B 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 {**(F15B 11/10 takes precedence)**}** |
| F15B 9/02 | . with servomotors of the reciprocatable or oscillatable type |
| F15B 9/03 | . . with electrical control means {(F15B 9/07 , F15B 9/09 , F15B 9/17 take precedence)} |
| F15B 9/04 | . . controlled by varying the output of a pump with variable capacity |
| F15B 9/06 | . . controlled by means using a fluid jet |
| F15B 9/07 | . . . with electrical control means |
| F15B 9/08 | . . controlled by valves affecting the fluid feed or the fluid outlet of the servomotor (F15B 9/06 takes precedence) |
| F15B 9/09 | . . . with electrical control means |
| F15B 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 |
| F15B 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 |
| F15B 9/14 | . with rotaty servomotors |

F15B 9/16 . Systems essentially having two or more interacting servomotors,{e.g. multi-stage (F15B 18/00 , F15B 20/00 take precedence; servo-operated pilot valves for the following stage F15B 13/042)}

F15B 9/17 . . with electrical control means

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**F15B 11/00** **Servomotor systems without provision for follow-up action;{Circuits therefor }**(F15B 3/00 takes precedence)

F15B 11/003 . {Systems with load-holding valves (locking valve details F15B 13/01)}

F15B 11/006 . {Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link}

F15B 11/02 . Systems ess entially incorporating special features for controlling the speed or actuating force of an output member

F15B 11/022 . . {in which a rapid approach stroke is followed by a slower, high-force working stroke (F15B 11/0325 takes precedence)}

F15B 11/024 . . by means of differential connection of the servomotor lines, e.g. regenerative circuits {(interconnecting valve details F15B 13/021)}

F15B 2011/0243 . . . {the regenerative circuit being activated or deactivated automatically}

F15B 2011/0246 . . . {with variable regeneration flow}

F15B 11/028 . . for controlling the actuating force (F15B 11/024 takes precedence)

F15B 11/032 . . . by means of fluid-pressure converters (fluid-pressure converters per se F15B 3/00)

F15B 11/0325 . . . . {the fluid-pressure converter increasing the working force after an approach stroke}

F15B 11/036 . . . by means of servomotors having a plurality of working chambers (servomotors per se F15B 15/00)

F15B 11/0365 . . . . {Tandem constructions}

F15B 11/04 . . for controlling the speed (F15B 11/024 takes precedence)

F15B 11/0406 . . . {during starting or stopping (F15B 11/048 takes precedence)}

F15B 11/0413 . . . {in one direction only, with no control in the reverse direction, e.g. check valve in parallel with a throttle valve}

F15B 11/042 . . . by regulating means in feed line,{i.e. "meter in" }(F15B 11/046 , F15B 11/05 take precedence)

F15B 11/0423 . . . . {by controlling pump output or bypass, other than to maintain constant speed (adjusting pump output or bypass to maintain constant speed F15B 11/055)}

F15B 11/0426 . . . . {by controlling the number of pumps or parallel valves switched on}

F15B 11/044 . . . by regulating means in return line,{i.e. "meter out" }(F15B 11/046 , F15B 11/05 take precedence)

F15B 11/0445 . . . . {with counterbalance valves, e.g. to prevent overrunning or for braking}

F15B 11/046 . . . depending on the position of the working member

F15B 11/048 . . . . with deceleration control

F15B 11/05 . . . specially adapted to maintain constant speed, e.g. pressure-compensated, load-responsive {(F15B 11/161 takes precedence) ; counterbalance valves F15B 11/0445 ; valves for load sensing F15B 13/0416}

F15B 11/055 . . . . {by adjusting the pump output or bypass (pump control F04B 49/00)}

F15B 11/06 . involving features specific to the use of a compressible medium, e.g. air, steam

F15B 11/064 .. with devices for saving the compressible medium

F15B 11/068 .. with valves for gradually putting pneumatic systems under pressure

F15B 11/072 .. Combined pneumatic-hydraulic systems (F15B 11/032 takes precedence)

F15B 11/0725 ... {with the driving energy being derived from a pneumatic system, a subsequent hydraulic system displacing or controlling the output element}

F15B 11/076 ... with pneumatic drive or displacement and speed control or stopping by hydraulic braking

F15B 11/08 . with only one servomotor

F15B 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}

F15B 11/12 .. providing distinct intermediate positions; with step-by-step action{ with a number of pistons in a single cylinder step-by-step action obtained by combining two or more servomotors F15B 11/18 ; (for restricting the stroke F15B 15/24)}

F15B 11/121 ... {providing distinct intermediate positions (F15B 11/13 takes precedence)}

F15B 11/122 .... {by means of actuators with multiple stops}

F15B 11/123 .... {by means of actuators with fluid-operated stops}

F15B 11/125 .... {by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes}

F15B 11/126 .... {by means of actuators of the standard type with special circuit controlling means (F15B 11/125 takes precedence)}

F15B 11/127 ... {with step-by-step action}

F15B 11/128 .... {by means of actuators of the standard type with special circuit controlling means}

F15B 11/13 ... using {separate dosing}chambers of predetermined volume

F15B 11/15 .. with special provision for automatic return {(fluid gearing with oscillating input or output F16H 43/00)}

F15B 11/16 . with two or more servomotors {(for soil-shifting machines E02F 9/22)}

F15B 11/161 .. {with sensing of servomotor demand or load}

F15B 11/162 ... {for giving priority to particular servomotors or users (priority valve details F15B 13/022 ; for power steering B62D 5/07)}

F15B 11/163 ... {for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation}

F15B 11/165 ... {for adjusting the pump output or bypass in response to demand}

F15B 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}

F15B 11/167 ... {using pilot pressure to sense the demand}

F15B 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}

F15B 11/17 .. using two or more pumps

F15B 11/18 .. used in combination for obtaining stepwise operation of a single controlled member

F15B 11/183 ... {Linear stepwise operation}

F15B 11/186 ... {Rotary stepwise operation}

F15B 11/20 . . controlling several interacting or sequentially-operating members (fluid distribution or supply devices for the control of two or more servomotors F15B 13/06)

F15B 11/205 . . . {the position of the actuator controlling the fluid flow to the subsequent actuator (telescopic booms B66C 23/70)}

F15B 11/22 . . Synchronisation of the movement of two or more servomotors

**F15B 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 })

F15B 2013/002 . {Modular valves, i.e. consisting of an assembly of interchangeable components}

F15B 2013/004 . . {Cartridge valves}

F15B 2013/006 . . {Modular components with multiple uses, e.g. kits for either normally-open or normally-closed valves, interchangeable or reprogrammable manifolds}

F15B 2013/008 . {Throttling member profiles}

F15B 13/01 . Locking-valves or other detent,{i.e. load-holding}, devices (associated with the actuator F15B 15/26 ; { systems with load-holding valves F15B 11/003 })

F15B 13/015 . . {using an enclosed pilot flow valve}

F15B 13/02 . Fluid distribution or supply devices characterised by their adaptation to the control of servomotors ({ F15B 11/15 takes precedence } ; multiple-way valves F16K 11/00)

**WARNING**

Subgroups F15B 13/023 to F15B 13/029 are not complete, see F15B 13/02

F15B 13/021 . . {Valves for interconnecting the fluid chambers of an actuator (regenerative circuits F15B 11/024)}

F15B 13/022 . . {Flow-dividers; Priority valves (circuits for giving priority to particular servomotors F15B 11/162 ; priority valves for power steering B62D 5/07)}

F15B 13/023 . . {Excess flow valves, e.g. for locking cylinders in case of hose burst}

F15B 13/024 . . {Pressure reflief valves}

F15B 13/025 . . {Pressure reducing valves}

F15B 13/026 . . {Pressure compensating valves}

F15B 13/027 . . {Check valves}

F15B 13/028 . . {Shuttle valves}

F15B 13/029 . . {Counterbalance valves}

F15B 13/04 . . for use with a single servomotor

F15B 13/0401 . . . {Valve members; Fluid interconnections therefor}

F15B 13/0402 . . . . {for linearly sliding valves, e.g. spool valves}

F15B 13/0403 . . . . . {a secondary valve member sliding within the main spool, e.g. for regeneration flow (F15B 13/0418 takes precedence)}

F15B 13/0405 . . . . {for seat valves, i.e. poppet valves}

F15B 13/0406 . . . . {for rotary valves}

F15B 13/0407 . . . . {Means for damping the valve member movement}

F15B 2013/0409 . . . . {Position sensing or feedback of the valve member}

F15B 2013/041 . . . . {with two positions}

F15B 2013/0412 .... {with three positions}

F15B 2013/0413 .... {with four or more positions}

F15B 2013/0414 .... {Dosing devices}

F15B 13/0416 ... {with means or adapted for load sensing (fluid systems with load sensing F15B 11/05 , F15B 11/161)}

F15B 13/0417 .... {Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves}

F15B 13/0418 ..... {Load sensing elements sliding within a hollow main valve spool}

F15B 13/042 ... operated by fluid pressure {(F15B 13/0401 , F15B 13/0416 take precedence)}

F15B 13/0422 .... {with manually-operated pilot valves, e.g. joysticks (arrangements of handles or pedals for cranes B66C 13/54 ; control levers for dredgers and soil shifting machines E02F 9/2004 ; similar mechanical control actuators G05G 9/047)}

F15B 13/0424 ..... {the joysticks being provided with electrical switches or sensors}

F15B 13/0426 .... {with fluid-operated pilot valves, i.e. multiple stage valves}

F15B 2013/0428 .... {with switchable internal or external pilot pressure source}

F15B 13/043 .... with electrically-controlled pilot valves{ electrically-operated main valves F15B 13/044}

F15B 13/0431 ..... {the electrical control resulting in an on-off function}

F15B 13/0433 ..... {the pilot valves being pressure control valves (F15B 13/0435 , F15B 13/0436 , F15B 13/0438 take precedence)}

F15B 13/0435 ..... {the pilot valves being sliding valves}

F15B 13/0436 ..... {the pilot valves being of the steerable jet type}

F15B 13/0438 ..... {the pilot valves being of the nozzle-flapper type}

F15B 13/044 ... operated by electrically-controlled means, e.g. solenoids, torque-motors {(electrically-controlled pilot valves F15B 13/043)}

F15B 13/0442 .... {with proportional solenoid allowing stable intermediate positions}

F15B 13/0444 .... {with rotary electric motor}

F15B 13/0446 .... {with moving coil, e.g. voice coil}

F15B 2013/0448 .... {Actuation by solenoid and permanent magnet}

F15B 13/06 .. for use with two or more servomotors

F15B 13/07 ... in distinct sequence

F15B 13/08 ... Assemblies of units, each for the control of a single servomotor only

F15B 13/0803 .... {Modular units}

F15B 13/0807 ..... {Manifolds}

F15B 13/081 ..... {Laminated constructions}

F15B 13/0814 ..... {Monoblock manifolds}

F15B 13/0817 ..... {Multiblock manifolds}

F15B 13/0821 ..... {Attachment or sealing of modular units to each other}

F15B 13/0825 ..... {the modular elements being mounted on a common member, e.g. on a rail}

F15B 13/0828 ..... {characterised by sealing means of the modular units}

F15B 13/0832 ..... {Modular valves}

F15B 13/0835 . . . . . {Cartridge type valves}

F15B 13/0839 . . . . . {Stacked plate type valves}

F15B 13/0842 . . . . . {Monoblock type valves, e.g. with multiple valve spools in a common housing}

F15B 13/0846 . . . . . {Electrical details}

F15B 13/085 . . . . . {Electrical controllers}

F15B 13/0853 . . . . . {Electric circuit boards}

F15B 13/0857 . . . . . {Electrical connecting means, e.g. plugs, sockets}

F15B 13/086 . . . . . {Sensing means, e.g. pressure sensors}

F15B 13/0864 . . . . . {Signalling means, e.g. LEDs}

F15B 13/0867 . . . . . {Data bus systems}

F15B 13/0871 . . . . . {Channels for fluid}

F15B 13/0875 . . . . . {Channels for electrical components, e.g. for cables or sensors}

F15B 13/0878 . . . . . {Assembly of modular units}

F15B 13/0882 . . . . . {using identical modular elements}

F15B 13/0885 . . . . . {using valves combined with other components}

F15B 13/0889 . . . . . {Valves combined with electrical components}

F15B 13/0892 . . . . . {Valves combined with fluid components}

F15B 13/0896 . . . . . {using different types or sizes of valves}

F15B 13/10 . Special arrangements for operating the actuated device {with or}without using fluid pressure, e.g. for emergency use

F15B 13/12 . Special measures for increasing the sensitivity of the system

F15B 13/14 . Special measures for giving the operating person a "feeling" of the response of the actuated device

F15B 13/16 . Special measures for feedback,{e.g. by a follow-up device (servomotors with follow-up action F15B 9/00 ; devices with means or adapted for load sensing F15B 13/0416)}

**F15B 15/00** **Fluid-actuated devices for displacing a member from one position to another** (motors for continuous movement F01 to F03)**; Gearing associated therewith**

F15B 15/02 . Mechanical lay-out characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member

F15B 15/04 . . with oscillating cylinder

F15B 15/06 . . for mechanically converting rectilinear movement into non- rectilinear movement

F15B 15/061 . . . {by unidirectional means}

F15B 15/063 . . . {Actuator having both linear and rotary output, i.e. dual action actuator}

F15B 15/065 . . . {the motor being of the rack-and-pinion type}

F15B 15/066 . . . {the motor being of the scotch yoke type}

F15B 15/068 . . . {the motor being of the helical type}

F15B 15/08 . characterised by the construction of the motor unit (pistons, cylinders, packing F16J)

F15B 15/082 . . {the motor being of the slotted cylinder type (locking mechanisms therefor F15B 15/265)}

F15B 15/084 . . {the motor being of the rodless piston type, e.g. with cable, belt or chain (locking mechanisms therefor F15B 15/265)}

F15B 15/086 . . . {with magnetic coupling}

F15B 15/088 . . {the motor using combined actuation, e.g. electric and fluid actuation}

**WARNING**

Not complete, see also F15B 15/08 , **F15B15/20M**

F15B 15/10 . . the motor being of diaphragm type (connection of valves to inflatable elastic bodies B60C 29/00; diaphragms, bellows F16J 3/00 ; { clutches with a fluid-actuated elastic clutching member F16D 25/04 })

F15B 15/103 . . . {using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators}

F15B 15/106 . . . {the motor being of the pinching-roller type}

F15B 15/12 . . of the oscillating-vane or curved-cylinder type

F15B 15/125 . . . {of the curved-cylinder type}

F15B 15/14 . . of the straight-cylinder type

F15B 15/1404 . . . {in clusters, e.g. multiple cylinders in one block (servomotors having a plurality of working chambers F15B 11/036 ; motors with two or more independently movable working pistons F15B 15/1409)}

F15B 15/1409 . . . {with two or more independently movable working pistons (systems F15B 11/12 , F15B 11/18)}

F15B 15/1414 . . . {with non-rotatable piston}

F15B 15/1419 . . . . {of non-circular cross-section}

F15B 15/1423 . . . {Component parts; Constructional details}

F15B 15/1428 . . . . {Cylinders (F15B 15/1438 takes precedence)}

F15B 15/1433 . . . . {End caps (F15B 15/1438 takes precedence)}

F15B 15/1438 . . . . {Cylinder to end cap assemblies}

F15B 15/1442 . . . . . {End cap sealings}

**WARNING**

Not complete, see also F15B 15/1438

F15B 15/1447 . . . . {Pistons; Piston to piston rod assemblies}

F15B 15/1452 . . . . . {Piston sealings}

**WARNING**

Not complete, see also F15B 15/1447

F15B 15/1457 . . . . {Piston rods (F15B 15/1447 takes precedence)}

F15B 15/1461 . . . . . {Piston rod sealings}

**WARNING**

Not complete, see also F15B 15/1457

F15B 15/1466 .... {Hollow piston sliding over a stationary rod inside the cylinder (systems for controlling the actuator force F15B 11/036)}

F15B 15/1471 .... {Guiding means other than in the end cap (F15B 15/1466 takes precedence)}

F15B 15/1476 .... {Special return means}

F15B 15/148 .... {Lost-motion means between the piston and the output}

F15B 15/1485 .... {Special measures for cooling or heating}

F15B 15/149 ... {Fluid interconnections, e.g. fluid connectors, passages}

F15B 2015/1495 ... {with screw mechanism attached to the piston}

F15B 15/16 ... of the telescopic type

F15B 15/165 .... {with synchronisation of sections}

F15B 15/17 ... of differential-piston type

F15B 15/18 . Combined units comprising both motor and pump {(telemotors F15B 7/00)}

F15B 15/19 . Pyrotechnical actuators

F15B 15/20 . Other details {e.g. assembly with regulating devices}

F15B 15/202 .. {Externally-operated valves mounted in or on the actuator}

F15B 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)}

F15B 2015/206 .. {Combined actuation, e.g. electric and fluid actuated}

F15B 2015/208 .. {Special fluid pressurisation means, e.g. thermal or electrolytic}

F15B 15/22 .. for accelerating or decelerating the stroke

F15B 15/221 ... {for accelerating the stroke, e.g. by area increase}

F15B 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}

F15B 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}

F15B 15/224 ... {having a piston which closes off fluid outlets in the cylinder bore by its own movement}

F15B 15/225 ... {with valve stems operated by contact with the piston end face or with the cylinder wall}

F15B 15/226 ... {having elastic elements, e.g. springs, rubber pads}

F15B 15/227 ... {having an auxiliary cushioning piston within the main piston or the cylinder end face}

F15B 15/228 ... {having shock absorbers mounted outside the actuator housing}

F15B 15/24 .. for restricting the stroke

F15B 15/26 .. Locking mechanisms {(locking valves not combined with the actuator F15B 13/01)}

F15B 15/261 ... {using positive interengagement, e.g. balls and grooves, for locking in the end positions}

F15B 15/262 ... {using friction, e.g. brake pads}

F15B 15/264 .... {Screw mechanisms attached to the piston}

F15B 15/265 ... {specially adapted for rodless pistons or slotted cylinders}

F15B 2015/267 ... {Manual locking or release}

F15B 2015/268 . . . {Fluid supply for locking or release independent of actuator pressurisation}

F15B 15/28 . . Means for indicating the position, e.g. end of stroke

F15B 15/2807 . . . {Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches}

F15B 15/2815 . . . {Position sensing, i.e. means for continuous measurement of position, e.g. LVDT}

**WARNING**

Subgroups F15B 15/2846 to F15B 15/2884 are not complete, see F15B 15/2815

F15B 15/2823 . . . . {by a screw mechanism attached to the piston}

F15B 15/283 . . . . {using a cable wrapped on a drum and attached to the piston}

F15B 15/2838 . . . . {with out using position sensors, e.g. by volume flow measurement or pump speed}

F15B 15/2846 . . . . {using detection of markings, e.g. markings on the piston rod}

F15B 15/2853 . . . . {using potentiometers}

F15B 15/2861 . . . . {using magnetic means}

F15B 15/2869 . . . . {using electromagnetic radiation, e.g. radar or microwaves}

F15B 15/2876 . . . . . {using optical means, e.g. laser}

F15B 15/2884 . . . . {using sound, e.g. ultrasound}

F15B 15/2892 . . . {characterised by the attachment means}

**F15B 17/00** **Combinations of telemotor and servomotor systems**

F15B 17/02 . in which a telemotor operates the control member of a servomotor

**F15B 18/00** **Parallel arrangements of independent servomotor systems**

**F15B 19/00** **Testing;{Calibrating; Fault detection or monitoring; Simulation or modelling of}fluid-pressure systems or apparatus not otherwise provided for**

F15B 19/002 . {Calibrating}

F15B 19/005 . {Fault detection or monitoring}

F15B 19/007 . {Simulation or modelling}

**F15B 20/00** **Safety arrangements; Applications of safety devices** (safety devices in general F16P,{ F16P 3/22 }); **Emergency measures**

F15B 20/001 . {Double valve requiring the use of both hands simultaneously}

F15B 20/002 . {Electrical failure}

F15B 20/004 . {Fluid pressure supply failure}

F15B 20/005 . {Leakage; Spillage; Hose burst}

F15B 20/007 . {Overload}

F15B 20/008 . {Valve failure (F15B 18/00 takes precedence)}

**F15B 21/00** **Common features; Fluid-pressure systems, or details thereof, not covered by any preceding group**

F15B 21/001 . {Servomotor systems with fluidic control}

F15B 21/003 . {Systems with different interchangeable components, e.g. using preassembled kits}

F15B 21/005 . {Filling or draining of fluid systems}

F15B 21/006 . {Compensation or avoidance of ambient pressure variation (systems with a pressurised main reservoir F15B 1/265)}

F15B 21/008 . {Reduction of noise or vibration}

F15B 21/02 . Servomotor systems with programme control derived from a store or timing device; Control devices therefor ({ programme control in washing-machines D06F 33/04 } ; programme control in general G05B 19/00)

F15B 21/04 . Special measures taken in connection with the properties of the fluid, e.g. for venting, compensating for changes of viscosity, cooling, filtering, preventing churning

F15B 21/041 . . {Filtering; Removal or measurement of solid or liquid contamination}

F15B 21/042 . . {Cooling or heating of the fluid; Warming up fluid systems}

F15B 21/044 . . {Deaeration, venting, bleeding; Removal or measurement of undissolved gas (preventing cavitation F15B 21/047)}

F15B 21/045 . . {Viscosity or temperature compensation (warming up fluid systems F15B 21/042)}

F15B 21/047 . . {Preventing foaming, churning or cavitation (supply reservoir or sump assemblies F15B 1/26)}

F15B 21/048 . . {Compressed air preparation units, e.g. comprising air driers or condensors, filters, oilers or lubricators, pressure regulators (for steam traps F16T ; for mist lubrication F16N 7/32 ; for air conditioning F24F)}

F15B 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

F15B 21/065 . . {Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid}

F15B 21/08 . Servomotor systems incorporating electrically operated control means (F15B 21/02 , { F15B 21/065 }take precedence)

F15B 21/082 . . {with different modes}

F15B 21/085 . . {using a data bus, e.g. "CANBUS"}

F15B 21/087 . . {Control strategy, e.g. with block diagram}

F15B 21/10 . Delay devices or arrangements ({ hydraulic braking F15B 11/076 } ; associated with fluid motors or actuators F15B 15/22)

F15B 21/12 . Fluid oscillators or pulse generators (fluid oscillators predominantly used for computing or control purposes F15C 1/22 , F15C 3/16)

F15B 21/125 . . {by means of a rotating valve}

F15B 21/14 . Energy recuperation means (for vehicles B60T 1/10);{Means for reducing energy consumption (regenerative circuits F15B 11/024)}

**F15B 2201/00** **Accumulators**

F15B 2201/20 . Accumulator cushioning means

F15B 2201/205 . . using gas

F15B 2201/21 . . using springs

F15B 2201/215 . . using weights

F15B 2201/22 . . using elastic housings
F15B 2201/30 . Accumulator separating means
F15B 2201/305 . . without separating means
F15B 2201/31 . . having rigid separating means, e.g. pistons
F15B 2201/312 . . . Sealings therefor, e.g. piston rings
F15B 2201/315 . . having flexible separating means
F15B 2201/3151 . . . the flexible separating means being diaphragms or membranes
F15B 2201/3152 . . . the flexible separating means being bladders
F15B 2201/3153 . . . the flexible separating means being bellows
F15B 2201/3154 . . . the flexible separating means being completely enclosed, e.g. using gas-filled balls or foam
F15B 2201/3155 . . . characterised by the material of the flexible separating means
F15B 2201/3156 . . . characterised by their attachment
F15B 2201/3157 . . . Sealings for the flexible separating means
F15B 2201/3158 . . . Guides for the flexible separating means, e.g. for a collapsed bladder
F15B 2201/32 . . having multiple separating means, e.g. with an auxiliary piston sliding within a main piston, multiple membranes or combinations thereof
F15B 2201/40 . Constructional details of accumulators not otherwise provided for
F15B 2201/405 . . Housings
F15B 2201/4053 . . . characterised by the material
F15B 2201/4056 . . . characterised by the attachment of housing components
F15B 2201/41 . . Liquid ports
F15B 2201/411 . . . having valve means
F15B 2201/413 . . . having multiple liquid ports
F15B 2201/415 . . Gas ports
F15B 2201/4155 . . . having valve means
F15B 2201/42 . . Heat recuperators for isothermal compression and expansion
F15B 2201/43 . . Anti-extrusion means
F15B 2201/435 . . . being fixed to the separating means
F15B 2201/50 . Monitoring, detection and testing means for accumulators
F15B 2201/505 . . Testing of accumulators, e.g. for testing tightness
F15B 2201/51 . . Pressure detection
F15B 2201/515 . . Position detection for separating means
F15B 2201/60 . Assembling or methods for making accumulators
F15B 2201/605 . . Assembling or methods for making housings therefor
F15B 2201/61 . . Assembling or methods for making separating means therefor
F15B 2201/615 . . Assembling or methods for making ports therefor

**F15B 2211/00 Circuits for servomotor systems**

F15B 2211/20 . Fluid pressure source, e.g. accumulator or variable axial piston pump
F15B 2211/205 . . Systems with pumps

F15B 2211/20507 . . . Type of prime mover
F15B 2211/20515 . . . . Electric motor
F15B 2211/20523 . . . . Internal combustion engine
F15B 2211/2053 . . . Type of pump
F15B 2211/20538 . . . . constant capacity
F15B 2211/20546 . . . . variable capacity
F15B 2211/20553 . . . . . with pilot circuit, e.g. for controlling a swash plate
F15B 2211/20561 . . . . reversible
F15B 2211/20569 . . . . capable of working as pump and motor
F15B 2211/20576 . . . with multiple pumps
F15B 2211/20584 . . . . Combinations of pumps with high and low capacity
F15B 2211/20592 . . . . Combinations of pumps for supplying high and low pressure
F15B 2211/21 . . Systems with pressure sources other than pumps, e.g. with a pyrotechnical charge
F15B 2211/212 . . . the pressure sources being accumulators
F15B 2211/214 . . . the pressure sources being hydrotransformers
F15B 2211/216 . . . the pressure sources being pneumatic-to-hydraulic converters
F15B 2211/218 . . . the pressure sources being pyrotechnical charges
F15B 2211/25 . . Pressure control functions
F15B 2211/251 . . . High pressure control
F15B 2211/252 . . . Low pressure control
F15B 2211/253 . . . Pressure margin control, e.g. pump pressure in relation to load pressure
F15B 2211/255 . . Flow control functions
F15B 2211/26 . . Power control functions
F15B 2211/265 . . Control of multiple pressure sources
F15B 2211/2652 . . . without priority
F15B 2211/2654 . . . one or more pressure sources having priority
F15B 2211/2656 . . . by control of the pumps
F15B 2211/2658 . . . by control of the prime movers
F15B 2211/27 . . Directional control by means of the pressure source
F15B 2211/275 . . Control of the prime mover, e.g. hydraulic control
F15B 2211/30 . Directional control
F15B 2211/305 . . characterised by the type of valves
F15B 2211/30505 . . . Non-return valves, i.e. check valves
F15B 2211/3051 . . . . Cross-check valves
F15B 2211/30515 . . . . Load holding valves
F15B 2211/3052 . . . Shuttle valves
F15B 2211/30525 . . . Directional control valves, e.g. 4/3-directional control valve
F15B 2211/3053 . . . . In combination with a pressure compensating valve
F15B 2211/30535 . . . . . the pressure compensating valve is arranged between pressure source and directional control valve

F15B 2211/3054 ..... the pressure compensating valve is arranged between directional control valve and output member

F15B 2211/30545 ..... the pressure compensating valve is arranged between output member and directional control valve

F15B 2211/3055 ..... the pressure compensating valve is arranged between directional control valve and return line

F15B 2211/30555 ..... Inlet and outlet of the pressure compensating valve being connected to the directional control valve

F15B 2211/3056 ... Assemblies of multiple valves

F15B 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

F15B 2211/3057 ..... having two valves, one for each port of a double-acting output member

F15B 2211/30575 ..... in a Wheatstone Bridge arrangement (also half bridges)

F15B 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)

F15B 2211/30585 .... having a single valve for multiple output members

F15B 2211/3059 .... having multiple valves for multiple output members

F15B 2211/30595 ..... with additional valves between the groups of valves for multiple output members

F15B 2211/31 .. characterised by the positions of the valve element

F15B 2211/3105 ... Neutral or centre positions

F15B 2211/3111 .... the pump port being closed in the centre position, e.g. so-called closed centre

F15B 2211/3116 .... the pump port being open in the centre position, e.g. so-called open centre

F15B 2211/3122 ... Special positions other than the pump port being connected to working ports or the working ports being connected to the return line

F15B 2211/3127 .... Floating position connecting the working ports and the return line

F15B 2211/3133 .... Regenerative position connecting the working ports or connecting the working ports to the pump, e.g. for high-speed approach stroke

F15B 2211/3138 ... the positions being discrete

F15B 2211/3144 ... the positions being continuously variable, e.g. as realised by proportional valves

F15B 2211/315 .. characterised by the connections of the valve or valves in the circuit

F15B 2211/31505 ... being connected to a pressure source and a return line

F15B 2211/31511 .... having a single pressure source

F15B 2211/31517 .... having multiple pressure sources

F15B 2211/31523 ... being connected to a pressure source and an output member

F15B 2211/31529 .... having a single pressure source and a single output member

F15B 2211/31535 .... having multiple pressure sources and a single output member

F15B 2211/31541 .... having a single pressure source and multiple output members

F15B 2211/31547 .... having multiple pressure sources and multiple output members

F15B 2211/31552 ... being connected to an output member and a return line

F15B 2211/31558 .... having a single output member
F15B 2211/31564 .... having multiple output members
F15B 2211/3157 ... being connected to a pressure source, an output member and a return line
F15B 2211/31576 .... having a single pressure source and a single output member
F15B 2211/31582 .... having multiple pressure sources and a single output member
F15B 2211/31588 .... having a single pressure source and multiple output members
F15B 2211/31594 .... having multiple pressure sources and multiple output members
F15B 2211/32 .. characterised by the type of actuation
F15B 2211/321 ... mechanically
F15B 2211/322 .... actuated by biasing means, e.g. spring-actuated
F15B 2211/323 ..... the biasing means being adjustable
F15B 2211/324 .... manually, e.g. by using a lever or pedal
F15B 2211/325 .... actuated by an output member of the circuit
F15B 2211/326 ..... with follow-up action
F15B 2211/327 ... electrically or electronically
F15B 2211/328 .... with signal modulation, e.g. pulse width modulation (PWM)
F15B 2211/329 ... actuated by fluid pressure
F15B 2211/35 .. Directional control combined with flow control
F15B 2211/351 ... Flow control by regulating means in feed line, i.e. meter-in control
F15B 2211/353 ... Flow control by regulating means in return line, i.e. meter-out control
F15B 2211/355 .. Pilot pressure control
F15B 2211/36 .. Pilot pressure sensing
F15B 2211/365 .. Directional control combined with flow control and pressure control
F15B 2211/40 . Flow control
F15B 2211/405 .. characterised by the type of flow control means or valve
F15B 2211/40507 ... with constant throttles or orifices
F15B 2211/40515 ... with variable throttles or orifices
F15B 2211/40523 ... with flow dividers
F15B 2211/4053 .... using valves
F15B 2211/40538 .... using volumetric pumps or motors
F15B 2211/40546 ... with flow combiners
F15B 2211/40553 ... with pressure compensating valves
F15B 2211/40561 .... the pressure compensating valve arranged upstream of the flow control means
F15B 2211/40569 .... the pressure compensating valve arranged downstream of the flow control means
F15B 2211/40576 ... Assemblies of multiple valves
F15B 2211/40584 .... the flow control means arranged in parallel with a check valve
F15B 2211/40592 .... with multiple valves in parallel flow paths,
F15B 2211/41 .. characterised by the positions of the valve element

F15B 2211/411 ... the positions being discrete
F15B 2211/413 ... the positions being continuously variable, e.g. as realised by proportional valves
F15B 2211/415 .. characterised by the connections of the flow control means in the circuit
F15B 2211/41509 ... being connected to a pressure source and a directional control valve
F15B 2211/41518 .... being connected to multiple pressure sources
F15B 2211/41527 ... being connected to an output member and a directional control valve
F15B 2211/41536 .... being connected to multiple ports of an output member
F15B 2211/41545 .... being connected to multiple output members
F15B 2211/41554 ... being connected to a return line and a directional control valve
F15B 2211/41563 ... being connected to a pressure source and a return line
F15B 2211/41572 ... being connected to a pressure source and an output member
F15B 2211/41581 ... being connected to an output member and a return line
F15B 2211/4159 ... being connected to a pressure source, an output member and a return line
F15B 2211/42 .. characterised by the type of actuation
F15B 2211/421 ... mechanically
F15B 2211/422 .... actuated by biasing means, e.g. spring-actuated
F15B 2211/423 .... manually, e.g. by using a lever or pedal
F15B 2211/424 .... actuated by an output member of the circuit
F15B 2211/425 ..... with follow-up action
F15B 2211/426 ... electrically or electronically
F15B 2211/427 .... with signal modulation, e.g. using pulse width modulation (PWM)
F15B 2211/428 ... actuated by fluid pressure
F15B 2211/45 .. Control of bleed-off flow, e.g. control of bypass flow to the return line
F15B 2211/455 .. Control of flow in the feed line, i.e. meter-in control
F15B 2211/46 .. Control of flow in the return lin, i.e. meter-out control
F15B 2211/465 .. Flow control with pressure compensation
F15B 2211/47 .. Flow control in one direction only
F15B 2211/473 ... without restriction in the reverse direction
F15B 2211/476 ... the flow in the reverse direction being blocked
F15B 2211/50 . Pressure control
F15B 2211/505 .. characterised by the type of pressure control means
F15B 2211/50509 ... the pressure control means controlling a pressure upstream of the pressure control means
F15B 2211/50518 .... using pressure relief valves
F15B 2211/50527 ..... using cross-pressure relief valves
F15B 2211/50536 .... using unloading valves controlling the supply pressure by diverting fluid to the return line
F15B 2211/50545 .... using braking valves to maintain a back pressure
F15B 2211/50554 ... the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve
F15B 2211/50563 ... the pressure control means controlling a differential pressure

F15B 2211/50572 .... using a pressure compensating valve for controlling the pressure difference across a flow control valve
F15B 2211/50581 .... using counterbalance valves
F15B 2211/5059 ..... using double counterbalance valves
F15B 2211/51 .. characterised by the positions of the valve element
F15B 2211/511 ... the positions being discrete
F15B 2211/513 ... the positions being continuously variable, e.g. as realised by proportional valves
F15B 2211/515 .. characterised by the connections of the pressure control means in the circuit
F15B 2211/5151 ... being connected to a pressure source and a directional control valve
F15B 2211/5152 .... being connected to multiple pressure sources
F15B 2211/5153 ... being connected to an output member and a directional control valve
F15B 2211/5154 .... being connected to multiple ports of an output member
F15B 2211/5155 .... being connected to multiple output members
F15B 2211/5156 ... being connected to a return line and a directional control valve
F15B 2211/5157 ... being connected to a pressure source and a return line
F15B 2211/5158 ... being connected to a pressure source and an output member
F15B 2211/5159 ... being connected to an output member and a return line
F15B 2211/52 .. characterised by the type of actuation
F15B 2211/521 ... mechanically
F15B 2211/522 .... actuated by biasing means, e.g. spring-actuated
F15B 2211/523 .... manually, e.g. by using a lever or pedal
F15B 2211/524 .... actuated by an output member of the circuit
F15B 2211/525 ..... with follow-up action
F15B 2211/526 ... electrically or electronically
F15B 2211/527 .... with signal modulation, e.g. pulse width modulation (PWM)
F15B 2211/528 ... actuated by fluid pressure
F15B 2211/55 .. for limiting a pressure up to a maximum pressure, e.g. by using a pressure relief valve
F15B 2211/555 .. for assuring a minimum pressure, e.g. by using a back pressure valve
F15B 2211/56 .. Control of an upstream pressure
F15B 2211/565 .. Control of a downstream pressure
F15B 2211/57 .. Control of a differential pressure
F15B 2211/575 .. Pilot pressure control
F15B 2211/5753 ... for closing a valve
F15B 2211/5756 ... for opening a valve
F15B 2211/60 . Circuit components or control therefor
F15B 2211/605 .. Load sensing circuits
F15B 2211/6051 ... having valve means between output member and the load sensing circuit
F15B 2211/6052 .... using check valves
F15B 2211/6054 .... using shuttle valves

F15B 2211/6055 .... using pressure relief valves
F15B 2211/6057 .... using directional control valves
F15B 2211/6058 ... with isolator valves
F15B 2211/61 .. Secondary circuits
F15B 2211/611 ... Diverting circuits, e.g. for cooling or filtering
F15B 2211/613 ... Feeding circuits
F15B 2211/615 .. Filtering means
F15B 2211/62 .. Cooling or heating means
F15B 2211/625 .. Accumulators
F15B 2211/63 .. Electronic controllers
F15B 2211/6303 ... using input signals
F15B 2211/6306 .... representing a pressure
F15B 2211/6309 ..... the pressure being a pressure source supply pressure
F15B 2211/6313 ..... the pressure being a load pressure
F15B 2211/6316 ..... the pressure being a pilot pressure
F15B 2211/632 .... representing a flow rate
F15B 2211/6323 ..... the flow rate being a pressure source flow rate
F15B 2211/6326 ..... the flow rate being an output member flow rate
F15B 2211/633 .... representing a state of the prime mover, e.g. torque or rotational speed
F15B 2211/6333 .... representing a state of the pressure source, e.g. swash plate angle
F15B 2211/6336 .... representing a state of the output member, e.g. position, speed or acceleration
F15B 2211/634 .... representing a state of a valve
F15B 2211/6343 .... representing a temperature
F15B 2211/6346 .... representing a state of input means, e.g. joystick position
F15B 2211/635 .. Circuits providing pilot pressure to pilot pressure-controlled fluid circuit elements
F15B 2211/6355 ... having valve means
F15B 2211/65 .. Methods of control of the load sensing pressure
F15B 2211/651 ... characterised by the way the load pressure is communicated to the load sensing circuit
F15B 2211/652 ... the load sensing pressure being different from the load pressure
F15B 2211/653 ... the load sensing pressure being higher than the load pressure
F15B 2211/654 ... the load sensing pressure being lower than the load pressure
F15B 2211/655 .. Methods of contamination control, i.e. methods of control of the cleanliness of circuit components or of the pressure fluid
F15B 2211/66 .. Temperature control methods
F15B 2211/665 .. Methods of control using electronic components
F15B 2211/6651 ... Control of the prime mover, e.g. control of the output torque or rotational speed
F15B 2211/6652 ... Control of the pressure source, e.g. control of the swash plate angle
F15B 2211/6653 ... Pressure control
F15B 2211/6654 ... Flow rate control

F15B 2211/6655 . . . Power control, e.g. combined pressure and flow rate control
F15B 2211/6656 . . . Closed loop control, i.e. control using feedback
F15B 2211/6657 . . . Open loop control, i.e. control without feedback
F15B 2211/6658 . . . Control using different modes, e.g. four-quadrant-operation, working mode and transportation mode
F15B 2211/67 . . Methods for controlling pilot pressure
F15B 2211/70 . Output members, e.g. hydraulic motors or cylinders or control therefor
F15B 2211/705 . . characterised by the type of output members or actuators
F15B 2211/7051 . . . Linear output members
F15B 2211/7052 . . . . Single-acting output members
F15B 2211/7053 . . . . Double-acting output members
F15B 2211/7054 . . . . . Having equal piston areas
F15B 2211/7055 . . . . having more than two chambers
F15B 2211/7056 . . . . . Tandem cylinders
F15B 2211/7057 . . . . being of the telescopic type
F15B 2211/7058 . . . Rotary output members
F15B 2211/71 . . Multiple output members, e.g. multiple hydraulic motors or cylinders
F15B 2211/7107 . . . the output members being mechanically linked
F15B 2211/7114 . . . with direct connection between the chambers of different actuators
F15B 2211/7121 . . . . the chambers being connected in series
F15B 2211/7128 . . . . the chambers being connected in parallel
F15B 2211/7135 . . . Combinations of output members of different types, e.g. single-acting cylinders with rotary motors
F15B 2211/7142 . . . the output members being arranged in multiple groups
F15B 2211/715 . . having braking means
F15B 2211/72 . . having locking means
F15B 2211/75 . . Control of speed of the output member
F15B 2211/755 . . Control of acceleration or deceleration of the output member
F15B 2211/76 . . Control of force or torque of the output member
F15B 2211/761 . . . Control of a negative load, i.e. of a load generating hydraulic energy
F15B 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
F15B 2211/765 . . Control of position or angle of the output member
F15B 2211/7653 . . . at distinct positions, e.g. at the end position
F15B 2211/7656 . . . with continuous position control
F15B 2211/77 . . Control of direction of movement of the output member
F15B 2211/7708 . . . in one direction only
F15B 2211/7716 . . . with automatic return
F15B 2211/7725 . . . with automatic reciprocation
F15B 2211/7733 . . . providing vibrating movement, e.g. dither control for emptying a bucket

F15B 2211/7741 . . . with floating mode, e.g. using a direct connection between both lines of a double-acting cylinder

F15B 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

F15B 2211/78 . . Control of multiple output members

F15B 2211/781 . . . one or more output members having priority

F15B 2211/782 . . . Concurrent control, e.g. synchronisation of two or more actuators

F15B 2211/783 . . . Sequential control

F15B 2211/785 . . Compensation of the difference in flow rate in closed fluid circuits using differential actuators

F15B 2211/80 . Other types of control related to particular problems or conditions

F15B 2211/85 . . Control during special operating conditions

F15B 2211/851 . . . during starting

F15B 2211/853 . . . during stopping

F15B 2211/855 . . Testing of fluid pressure systems

F15B 2211/857 . . Monitoring of fluid pressure systems

F15B 2211/86 . . Control during or prevention of abnormal conditions

F15B 2211/8603 . . . the abnormal condition being an obstacle

F15B 2211/8606 . . . the abnormal condition being a shock

F15B 2211/8609 . . . the abnormal condition being cavitation

F15B 2211/8613 . . . the abnormal condition being oscillations

F15B 2211/8616 . . . the abnormal condition being noise or vibration

F15B 2211/862 . . . the abnormal condition being electric or electronic failure

F15B 2211/8623 . . . . Electric supply failure

F15B 2211/8626 . . . . Electronic controller failure, e.g. software, EMV, electromagnetic interference

F15B 2211/863 . . . the abnormal condition being a hydraulic or pneumatic failure

F15B 2211/8633 . . . . Pressure source supply failure

F15B 2211/8636 . . . . Circuit failure, e.g. valve or hose failure

F15B 2211/864 . . . . Failure of an output member, e.g. actuator or motor failure

F15B 2211/8643 . . . the abnormal condition being a human failure

F15B 2211/8646 . . . the abnormal condition being hysteresis

F15B 2211/865 . . Prevention of failures

F15B 2211/87 . . Detection of failures

F15B 2211/875 . . Control measures for coping with failures

F15B 2211/8752 . . . Emergency operation mode, e.g. fail-safe operation mode

F15B 2211/8755 . . . Emergency shut-down

F15B 2211/8757 . . . using redundant components or assemblies

F15B 2211/88 . . Control measures for saving energy

F15B 2211/885 . . Control specific to the type of fluid, e.g. specific to magnetorheological fluid

F15B 2211/8855 . . . Compressible fluids, e.g. specific to pneumatics

F15B 2211/89 . . Control specific for achieving vacuum or "negative pressure"

F15B 2211/895 . . Manual override

**F15B 2215/00 Fluid-actuated devices for displacing a member from one position to another**

F15B 2215/30 . Constructional details thereof

F15B 2215/305 . . characterised by the use of special materials