

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. 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 - 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.

<p>1/00 Installations or systems with accumulators; Supply reservoir or sump assemblies</p> <p>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)</p> <p>1/021 . . {used for damping}</p> <p>1/022 . . {used as an emergency power source, e.g. in case of pump failure}</p> <p>1/024 . . {used as a supplementary power source, e.g. to store energy in idle periods to balance pump load}</p> <p>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}</p> <p>1/027 . . having accumulator charging devices (control of fluid pressure in general G05D 16/00)</p> <p>1/0275 . . . {with two or more pilot valves, e.g. for independent setting of the cut-in and cut-out pressures}</p> <p style="padding-left: 20px;">WARNING</p> <p style="padding-left: 40px;">Not complete, see F15B 1/027</p> <p>1/033 . . . with electrical control means</p> <p>1/04 . . Accumulators (connection of valves to inflatable elastic bodies B60C 29/00)</p> <p>1/045 . . . {Dead weight accumulators}</p>	<p>1/08 . . . using a gas cushion; Gas charging devices; Indicators or floats therefor</p> <p>1/083 {the accumulator having a fusible plug}</p> <p>1/086 {the gas cushion being entirely enclosed by the separating means, e.g. foam or gas-filled balls}</p> <p>1/10 with flexible separating means</p> <p>1/103 {the separating means being bellows}</p> <p>1/106 {characterised by the way housing components are assembled}</p> <p>1/12 attached at their periphery (F15B 1/16 takes precedence)</p> <p>1/125 {characterised by the attachment means (F15B 1/14 takes precedence)}</p> <p>1/14 by means of a rigid annular supporting member</p> <p>1/16 in the form of a tube</p> <p>1/165 {in the form of a bladder}</p> <p>1/18 Anti-extrusion means</p> <p>1/20 fixed to the separating means</p> <p>1/22 Liquid port constructions</p> <p>1/24 with rigid separating means, e.g. pistons</p> <p>1/26 . . Supply reservoir or sump assemblies</p> <p>1/265 . . {with pressurised main reservoir (systems with accumulators F15B 1/02)}</p>
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- 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; for measuring or controlling [G01](#), [G05](#))
- 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)
- 9/08 . . controlled by valves affecting the fluid feed or the fluid outlet of the servomotor ([F15B 9/06](#) takes precedence)
- 9/09 . . . with electrical control means
- 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
- 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
- 9/14 . with rotary servomotors
- 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](#))}
- 9/17 . . with electrical control means

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** {(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](#))}
- 7/001 . {with multiple inputs (input units [F15B 7/08](#), e.g. for dual control)}
- 7/003 . {with multiple outputs}
- 7/005 . {with rotary or crank input (input units [F15B 7/08](#))}
- 7/006 . . {Rotary pump input}
- 7/008 . {with rotary output}
- 7/02 . Systems with continuously-operating input and output apparatus
- 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](#))
- 7/06 . Details ([F15B 15/00](#) takes precedence)
- 7/08 . . Input units; Master units
- 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](#))
- 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)}
- 9/02 . with servomotors of the reciprocable or oscillatable type
- 9/03 . . with electrical control means {([F15B 9/07](#), [F15B 9/09](#), [F15B 9/17](#) take precedence)}
- 9/04 . . controlled by varying the output of a pump with variable capacity
- 9/06 . . controlled by means using a fluid jet
- 9/07 . . . with electrical control means
- 11/00 Servomotor systems without provision for follow-up action; {Circuits therefor}** ([F15B 3/00](#) takes precedence)
- 11/003 . {Systems with load-holding valves (locking valve details [F15B 13/01](#))}
- 11/006 . {Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link}
- 11/02 . Systems essentially incorporating special features for controlling the speed or actuating force of an output member
- 11/022 . . {in which a rapid approach stroke is followed by a slower, high-force working stroke ([F15B 11/0325](#) takes precedence)}
- 11/024 . . by means of differential connection of the servomotor lines, e.g. regenerative circuits {(interconnecting valve details [F15B 13/021](#))}
- 2011/0243 . . . {the regenerative circuit being activated or deactivated automatically}
- 2011/0246 . . . {with variable regeneration flow}
- 11/028 . . for controlling the actuating force ([F15B 11/024](#) takes precedence)
- 11/032 . . . by means of fluid-pressure converters (fluid-pressure converters per se [F15B 3/00](#))
- 11/0325 {the fluid-pressure converter increasing the working force after an approach stroke}
- 11/036 . . . by means of servomotors having a plurality of working chambers (servomotors per se [F15B 15/00](#))
- 11/0365 {Tandem constructions}
- 11/04 . . for controlling the speed ([F15B 11/024](#) takes precedence)
- 11/0406 . . . {during starting or stopping ([F15B 11/048](#) 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}
- 11/042 . . . by means in the feed line {, i.e. "meter in"} ([F15B 11/046](#), [F15B 11/05](#) take precedence)
- 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](#))}

- 11/0426 {by controlling the number of pumps or parallel valves switched on}
- 11/044 . . . by means in the return line {, i.e. "meter out"} ([F15B 11/046](#), [F15B 11/05](#) take precedence)
- 11/0445 {with counterbalance valves, e.g. to prevent overrunning or for braking}
- 11/046 . . . depending on the position of the working member
- 11/048 with deceleration control
- 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](#))}
- 11/055 {by adjusting the pump output or bypass (pump control [F04B 49/00](#))}
- 11/06 . . involving features specific to the use of a compressible medium, e.g. air, steam
- 11/064 . . with devices for saving the compressible medium
- 11/068 . . with valves for gradually putting pneumatic systems under pressure
- 11/072 . . Combined pneumatic-hydraulic systems ([F15B 11/032](#) takes precedence)
- 11/0725 . . . {with the driving energy being derived from a pneumatic system, a subsequent hydraulic system displacing or controlling the output element}
- 11/076 . . . with pneumatic drive or displacement and speed control or stopping by hydraulic braking
- 11/08 . . with only one servomotor
- 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}
- 11/12 . . 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](#))}
- 11/121 . . . {providing distinct intermediate positions ([F15B 11/13](#) takes precedence)}
- 11/122 {by means of actuators with multiple stops}
- 11/123 {by means of actuators with fluid-operated stops}
- 11/125 {by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes}
- 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}
- 11/128 {by means of actuators of the standard type with special circuit controlling means}
- 11/13 . . . using {separate dosing} chambers of predetermined volume
- 11/15 . . with special provision for automatic return {(fluid gearing with oscillating input or output [F16H 43/00](#))}
- 11/16 . . with two or more servomotors {(for soil-shifting machines [E02F 9/22](#))}
- 11/161 . . {with sensing of servomotor demand or load}
- 11/162 . . . {for giving priority to particular servomotors or users (priority valve details [F15B 13/022](#); for power steering [B62D 5/07](#))}
- 11/163 . . . {for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation}
- 11/165 . . . {for adjusting the pump output or bypass in response to demand}
- 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}
- 11/167 . . . {using pilot pressure to sense the demand}
- 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}
- 11/17 . . using two or more pumps
- 11/18 . . used in combination for obtaining stepwise operation of a single controlled member
- 11/183 . . . {Linear stepwise operation}
- 11/186 . . . {Rotary stepwise operation}
- 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](#))
- 11/205 . . . {the position of the actuator controlling the fluid flow to the subsequent actuator (telescopic booms [B66C 23/70](#))}
- 11/22 . . Synchronisation of the movement of two or more servomotors
- 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}**
- 2013/002 . . {Modular valves, i.e. consisting of an assembly of interchangeable components}
- 2013/004 . . . {Cartridge valves}
- 2013/006 . . . {Modular components with multiple uses, e.g. kits for either normally-open or normally-closed valves, interchangeable or reprogrammable manifolds}
- 2013/008 . . {Throttling member profiles}
- 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](#)})
- 13/015 . . {using an enclosed pilot flow valve}
- 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](#)}
- 13/021 . . {Valves for interconnecting the fluid chambers of an actuator (regenerative circuits [F15B 11/024](#))}
- 13/022 . . {Flow-dividers; Priority valves (circuits for giving priority to particular servomotors [F15B 11/162](#); priority valves for power steering [B62D 5/07](#))}
- 13/023 . . {Excess flow valves, e.g. for locking cylinders in case of hose burst}
- 13/024 . . {Pressure relief valves}
- 13/025 . . {Pressure reducing valves}
- 13/026 . . {Pressure compensating valves}
- 13/027 . . {Check valves}
- 13/028 . . {Shuttle valves}
- 13/029 . . {Counterbalance valves}
- 13/04 . . for use with a single servomotor

13/0401	. . . {Valve members; Fluid interconnections therefor}	13/08	. . . Assemblies of units, each for the control of a single servomotor only
13/0402	. . . . {for linearly sliding valves, e.g. spool valves}	13/0803	. . . . {Modular units}
13/0403	. . . . . {a secondary valve member sliding within the main spool, e.g. for regeneration flow (F15B 13/0418 takes precedence) }	13/0807	. . . . . {Manifolds}
13/0405	. . . . {for seat valves, i.e. poppet valves}	13/081	. . . . . {Laminated constructions}
13/0406	. . . . {for rotary valves}	13/0814	. . . . . {Monoblock manifolds}
13/0407	. . . . {Means for damping the valve member movement}	13/0817	. . . . . {Multiblock manifolds}
2013/0409	. . . . {Position sensing or feedback of the valve member}	13/0821	. . . . . {Attachment or sealing of modular units to each other}
2013/041	. . . . {with two positions}	13/0825	. . . . . {the modular elements being mounted on a common member, e.g. on a rail}
2013/0412	. . . . {with three positions}	13/0828	. . . . . {characterised by sealing means of the modular units}
2013/0413	. . . . {with four or more positions}	13/0832	. . . . . {Modular valves}
2013/0414	. . . . {Dosing devices}	13/0835	. . . . . {Cartridge type valves}
13/0416	. . . {with means or adapted for load sensing (fluid systems with load sensing F15B 11/05, F15B 11/161) }	13/0839	. . . . . {Stacked plate type valves}
13/0417	. . . . {Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves}	13/0842	. . . . . {Monoblock type valves, e.g. with multiple valve spools in a common housing}
13/0418	. . . . . {Load sensing elements sliding within a hollow main valve spool}	13/0846	. . . . . {Electrical details}
13/042	. . . operated by fluid pressure {(F15B 13/0401, F15B 13/0416 take precedence)} }	13/085	. . . . . {Electrical controllers}
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) }	13/0853	. . . . . {Electric circuit boards}
13/0424	. . . . . {the joysticks being provided with electrical switches or sensors}	13/0857	. . . . . {Electrical connecting means, e.g. plugs, sockets}
13/0426	. . . . {with fluid-operated pilot valves, i.e. multiple stage valves}	13/086	. . . . . {Sensing means, e.g. pressure sensors}
2013/0428	. . . . {with switchable internal or external pilot pressure source}	13/0864	. . . . . {Signalling means, e.g. LEDs}
13/043	. . . . with electrically-controlled pilot valves {(electrically-operated main valves F15B 13/044)} }	13/0867	. . . . . {Data bus systems}
13/0431	. . . . . {the electrical control resulting in an on-off function}	13/0871	. . . . . {Channels for fluid}
13/0433	. . . . . {the pilot valves being pressure control valves (F15B 13/0435, F15B 13/0436, F15B 13/0438 take precedence) }	13/0875	. . . . . {Channels for electrical components, e.g. for cables or sensors}
13/0435	. . . . . {the pilot valves being sliding valves}	13/0878	. . . . . {Assembly of modular units}
13/0436	. . . . . {the pilot valves being of the steerable jet type}	13/0882	. . . . . {using identical modular elements}
13/0438	. . . . . {the pilot valves being of the nozzle-flapper type}	13/0885	. . . . . {using valves combined with other components}
13/044	. . . operated by electrically-controlled means, e.g. solenoids, torque-motors {(electrically-controlled pilot valves F15B 13/043)} }	13/0889	. . . . . {Valves combined with electrical components}
13/0442	. . . . {with proportional solenoid allowing stable intermediate positions}	13/0892	. . . . . {Valves combined with fluid components}
13/0444	. . . . {with rotary electric motor}	13/0896	. . . . . {using different types or sizes of valves}
13/0446	. . . . {with moving coil, e.g. voice coil}	13/10	. Special arrangements for operating the actuated device {with or} without using fluid pressure, e.g. for emergency use
2013/0448	. . . . {Actuation by solenoid and permanent magnet}	13/12	. Special measures for increasing the sensitivity of the system
13/06	. . for use with two or more servomotors	13/14	. Special measures for giving the operating person a "feeling" of the response of the actuated device
13/07	. . . in distinct sequence	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) }
		15/00	Fluid-actuated devices for displacing a member from one position to another (motors for continuous movement F01 - F03); Gearing associated therewith
		15/02	. Mechanical layout characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member
		15/04	. . with oscillating cylinder
		15/06	. . for mechanically converting rectilinear movement into non- rectilinear movement
		15/061	. . . {by unidirectional means}
		15/063	. . . {Actuator having both linear and rotary output, i.e. dual action actuator}

15/065	. . . {the motor being of the rack-and-pinion type}	15/16	. . . of the telescopic type
15/066	. . . {the motor being of the scotch yoke type}	15/165	. . . . {with synchronisation of sections}
15/068	. . . {the motor being of the helical type}	15/17	. . . of differential-piston type
15/08	. characterised by the construction of the motor unit (pistons, cylinders, packing F16J)	15/18	. Combined units comprising both motor and pump ({ telemotors F15B 7/00 })
15/082	. . {the motor being of the slotted cylinder type (locking mechanisms therefor F15B 15/265)}	15/19	. Pyrotechnical actuators
15/084	. . {the motor being of the rodless piston type, e.g. with cable, belt or chain (locking mechanisms therefor F15B 15/265)}	15/20	. Other details {, e.g. assembly with regulating devices}
15/086	. . . {with magnetic coupling}	15/202	. . {Externally-operated valves mounted in or on the actuator}
15/088	. . {the motor using combined actuation, e.g. electric and fluid actuation}	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)}
	WARNING	2015/206	. . {Combined actuation, e.g. electric and fluid actuated}
	Not complete, see also F15B 15/08 , F15B 2015/206	2015/208	. . {Special fluid pressurisation means, e.g. thermal or electrolytic}
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)}	15/22	. . for accelerating or decelerating the stroke
15/103	. . . {using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators}	15/221	. . . {for accelerating the stroke, e.g. by area increase}
15/106	. . . {the motor being of the pinching-roller type}	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}
15/12	. . of the oscillating-vane or curved-cylinder type	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}
15/125	. . . {of the curved-cylinder type}	15/224	. . . {having a piston which closes off fluid outlets in the cylinder bore by its own movement}
15/14	. . of the straight-cylinder type	15/225	. . . {with valve stems operated by contact with the piston end face or with the cylinder wall}
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)}	15/226	. . . {having elastic elements, e.g. springs, rubber pads}
15/1409	. . . {with two or more independently movable working pistons (systems F15B 11/12 , F15B 11/18)}	15/227	. . . {having an auxiliary cushioning piston within the main piston or the cylinder end face}
15/1414	. . . {with non-rotatable piston}	15/228	. . . {having shock absorbers mounted outside the actuator housing}
15/1419	. . . . {of non-circular cross-section}	15/24	. . for restricting the stroke
15/1423	. . . {Component parts; Constructional details}	15/26	. . Locking mechanisms ({ locking valves not combined with the actuator F15B 13/01 })
15/1428	. . . . {Cylinders (F15B 15/1438 takes precedence)}	15/261	. . . {using positive interengagement, e.g. balls and grooves, for locking in the end positions}
15/1433	. . . . {End caps (F15B 15/1438 takes precedence)}	15/262	. . . {using friction, e.g. brake pads}
15/1438	. . . . {Cylinder to end cap assemblies}	15/264	. . . . {Screw mechanisms attached to the piston}
15/1442	. . . . . {End cap sealings}	15/265	. . . {specially adapted for rodless pistons or slotted cylinders}
15/1447	. . . . . {Pistons; Piston to piston rod assemblies}	2015/267	. . . {Manual locking or release}
15/1452	. . . . . {Piston sealings}	2015/268	. . . {Fluid supply for locking or release independent of actuator pressurisation}
15/1457	. . . . . {Piston rods (F15B 15/1447 takes precedence)}	15/28	. . Means for indicating the position, e.g. end of stroke
15/1461	. . . . . {Piston rod sealings}	15/2807	. . . {Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches}
15/1466	. . . . . {Hollow piston sliding over a stationary rod inside the cylinder (systems for controlling the actuator force F15B 11/036)}	15/2815	. . . {Position sensing, i.e. means for continuous measurement of position, e.g. LVDT}
15/1471	. . . . . {Guiding means other than in the end cap (F15B 15/1466 takes precedence)}	15/2823	. . . . {by a screw mechanism attached to the piston}
15/1476	. . . . . {Special return means}	15/283	. . . . {using a cable wrapped on a drum and attached to the piston}
15/148	. . . . . {Lost-motion means between the piston and the output}	15/2838	. . . . {with out using position sensors, e.g. by volume flow measurement or pump speed}
15/1485	. . . . . {Special measures for cooling or heating}	15/2846	. . . . . {using detection of markings, e.g. markings on the piston rod}
15/149	. . . {Fluid interconnections, e.g. fluid connectors, passages}		
2015/1495	. . . {with screw mechanism attached to the piston}		

- 15/2853 {using potentiometers}
- 15/2861 {using magnetic means}
- 15/2869 {using electromagnetic radiation, e.g. radar or microwaves}
- 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**
- 17/02 . in which a telemotor operates the control member of a servomotor
- 18/00 Parallel arrangements of independent servomotor systems**
- 19/00 Testing; {Calibrating; Fault detection or monitoring; Simulation or modelling of} fluid-pressure systems or apparatus not otherwise provided for**
- 19/002 . {Calibrating}
- 19/005 . {Fault detection or monitoring}
- 19/007 . {Simulation or modelling}
- 20/00 Safety arrangements; Applications of safety devices (safety devices in general [F16P](#), [F16P 3/22](#)); Emergency measures**
- 20/001 . {Double valve requiring the use of both hands simultaneously}
- 20/002 . {Electrical failure}
- 20/004 . {Fluid pressure supply failure}
- 20/005 . {Leakage; Spillage; Hose burst}
- 20/007 . {Overload}
- 20/008 . {Valve failure ([F15B 18/00](#) takes precedence)}
- 21/00 Common features; Fluid-pressure systems, or details thereof, not covered by any preceding group**
- 21/001 . {Servomotor systems with fluidic control}
- 21/003 . {Systems with different interchangeable components, e.g. using preassembled kits}
- 21/005 . {Filling or draining of fluid systems}
- 21/006 . {Compensation or avoidance of ambient pressure variation (systems with a pressurised main reservoir [F15B 1/265](#))}
- 21/008 . {Reduction of noise or vibration}
- 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](#))
- 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
- 21/041 . . {Filtering; Removal or measurement of solid or liquid contamination}
- 21/042 . . {Cooling or heating of the fluid; Warming up fluid systems}
- 21/044 . . {Deaeration, venting, bleeding; Removal or measurement of undissolved gas ([preventing cavitation F15B 21/047](#))}
- 21/045 . . {Viscosity or temperature compensation ([warming up fluid systems F15B 21/042](#))}
- 21/047 . . {Preventing foaming, churning or cavitation ([supply reservoir or sump assemblies F15B 1/26](#))}
- 21/048 . . {Compressed air preparation units, e.g. comprising air driers or condensers, filters, oilers or lubricators, pressure regulators ([for steam traps F16T](#); [for mist lubrication F16N 7/32](#); [for air conditioning F24F](#))}
- 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
- 21/065 . . {Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid}
- 21/08 . Servomotor systems incorporating electrically operated control means ([F15B 21/02](#), [F15B 21/065](#)) take precedence
- 21/082 . . {with different modes}
- 21/085 . . {using a data bus, e.g. "CANBUS"}
- 21/087 . . {Control strategy, e.g. with block diagram}
- 21/10 . Delay devices or arrangements ([hydraulic braking F15B 11/076](#)); associated with fluid motors or actuators [F15B 15/22](#))
- 21/12 . Fluid oscillators or pulse generators ([fluid oscillators predominantly used for computing or control purposes F15C 1/22](#), [F15C 3/16](#))
- 21/125 . . {by means of a rotating valve}
- 21/14 . Energy recuperation means ([for vehicles B60T 1/10](#)); {Means for reducing energy consumption ([regenerative circuits F15B 11/024](#))}
- 2201/00 Accumulators**
- 2201/20 . Accumulator cushioning means
- 2201/205 . . using gas
- 2201/21 . . using springs
- 2201/215 . . using weights
- 2201/22 . . using elastic housings
- 2201/30 . Accumulator separating means
- 2201/305 . . without separating means
- 2201/31 . . having rigid separating means, e.g. pistons
- 2201/312 . . . Sealings therefor, e.g. piston rings
- 2201/315 . . having flexible separating means
- 2201/3151 . . . the flexible separating means being diaphragms or membranes
- 2201/3152 . . . the flexible separating means being bladders
- 2201/3153 . . . the flexible separating means being bellows
- 2201/3154 . . . the flexible separating means being completely enclosed, e.g. using gas-filled balls or foam
- 2201/3155 . . . characterised by the material of the flexible separating means
- 2201/3156 . . . characterised by their attachment
- 2201/3157 . . . Sealings for the flexible separating means
- 2201/3158 . . . Guides for the flexible separating means, e.g. for a collapsed bladder
- 2201/32 . . having multiple separating means, e.g. with an auxiliary piston sliding within a main piston, multiple membranes or combinations thereof
- 2201/40 . Constructional details of accumulators not otherwise provided for
- 2201/405 . . Housings
- 2201/4053 . . . characterised by the material
- 2201/4056 . . . characterised by the attachment of housing components
- 2201/41 . . Liquid ports
- 2201/411 . . . having valve means

- 2201/413 . . . having multiple liquid ports
- 2201/415 . . Gas ports
- 2201/4155 . . . having valve means
- 2201/42 . . Heat recuperators for isothermal compression and expansion
- 2201/43 . . Anti-extrusion means
- 2201/435 . . . being fixed to the separating means
- 2201/50 . Monitoring, detection and testing means for accumulators
- 2201/505 . . Testing of accumulators, e.g. for testing tightness
- 2201/51 . . Pressure detection
- 2201/515 . . Position detection for separating means
- 2201/60 . Assembling or methods for making accumulators
- 2201/605 . . Assembling or methods for making housings therefor
- 2201/61 . . Assembling or methods for making separating means therefor
- 2201/615 . . Assembling or methods for making ports therefor
- 2211/00 Circuits for servomotor systems**
- 2211/20 . Fluid pressure source, e.g. accumulator or variable axial piston pump
- 2211/205 . . Systems with pumps
- 2211/20507 . . . Type of prime mover
- 2211/20515 Electric motor
- 2211/20523 Internal combustion engine
- 2211/2053 . . . Type of pump
- 2211/20538 constant capacity
- 2211/20546 variable capacity
- 2211/20553 with pilot circuit, e.g. for controlling a swash plate
- 2211/20561 reversible
- 2211/20569 capable of working as pump and motor
- 2211/20576 with multiple pumps
- 2211/20584 Combinations of pumps with high and low capacity
- 2211/20592 Combinations of pumps for supplying high and low pressure
- 2211/21 . . Systems with pressure sources other than pumps, e.g. with a pyrotechnical charge
- 2211/212 . . . the pressure sources being accumulators
- 2211/214 . . . the pressure sources being hydrotransformers
- 2211/216 . . . the pressure sources being pneumatic-to-hydraulic converters
- 2211/218 . . . the pressure sources being pyrotechnical charges
- 2211/25 . . Pressure control functions
- 2211/251 . . . High pressure control
- 2211/252 . . . Low pressure control
- 2211/253 . . . Pressure margin control, e.g. pump pressure in relation to load pressure
- 2211/255 . . Flow control functions
- 2211/26 . . Power control functions
- 2211/265 . . Control of multiple pressure sources
- 2211/2652 . . . without priority
- 2211/2654 . . . one or more pressure sources having priority
- 2211/2656 . . . by control of the pumps
- 2211/2658 . . . by control of the prime movers
- 2211/27 . . Directional control by means of the pressure source
- 2211/275 . . Control of the prime mover, e.g. hydraulic control
- 2211/30 . Directional control
- 2211/305 . . characterised by the type of valves
- 2211/30505 . . . Non-return valves, i.e. check valves
- 2211/3051 Cross-check valves
- 2211/30515 Load holding valves
- 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
- 2211/30535 the pressure compensating valve is arranged between pressure source and directional control valve
- 2211/3054 the pressure compensating valve is arranged between directional control valve and output member
- 2211/30545 the pressure compensating valve is arranged between output member and directional control valve
- 2211/3055 the pressure compensating valve is arranged between directional control valve and return line
- 2211/30555 Inlet and outlet of the pressure compensating valve being connected to the directional control valve
- 2211/3056 . . . Assemblies of multiple valves
- 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
- 2211/3057 having two valves, one for each port of a double-acting output member
- 2211/30575 in a Wheatstone Bridge arrangement (also half bridges)
- 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](#))
- 2211/30585 having a single valve for multiple output members
- 2211/3059 having multiple valves for multiple output members
- 2211/30595 with additional valves between the groups of valves for multiple output members
- 2211/31 . . characterised by the positions of the valve element
- 2211/3105 . . . Neutral or centre positions
- 2211/3111 the pump port being closed in the centre position, e.g. so-called closed centre
- 2211/3116 the pump port being open in the centre position, e.g. so-called open centre
- 2211/3122 . . . Special positions other than the pump port being connected to working ports or the working ports being connected to the return line
- 2211/3127 Floating position connecting the working ports and the return line
- 2211/3133 Regenerative position connecting the working ports or connecting the working ports to the pump, e.g. for high-speed approach stroke
- 2211/3138 . . . the positions being discrete

- 2211/3144 . . . the positions being continuously variable, e.g. as realised by proportional valves
- 2211/315 . . characterised by the connections of the valve or valves in the circuit
- 2211/31505 . . . being connected to a pressure source and a return line
- 2211/31511 having a single pressure source
- 2211/31517 having multiple pressure sources
- 2211/31523 . . . being connected to a pressure source and an output member
- 2211/31529 having a single pressure source and a single output member
- 2211/31535 having multiple pressure sources and a single output member
- 2211/31541 having a single pressure source and multiple output members
- 2211/31547 having multiple pressure sources and multiple output members
- 2211/31552 . . . being connected to an output member and a return line
- 2211/31558 having a single output member
- 2211/31564 having multiple output members
- 2211/3157 . . . being connected to a pressure source, an output member and a return line
- 2211/31576 having a single pressure source and a single output member
- 2211/31582 having multiple pressure sources and a single output member
- 2211/31588 having a single pressure source and multiple output members
- 2211/31594 having multiple pressure sources and multiple output members
- 2211/32 . . characterised by the type of actuation
- 2211/321 mechanically
- 2211/322 actuated by biasing means, e.g. spring-actuated
- 2211/323 the biasing means being adjustable
- 2211/324 manually, e.g. by using a lever or pedal
- 2211/325 actuated by an output member of the circuit
- 2211/326 with follow-up action
- 2211/327 electrically or electronically
- 2211/328 with signal modulation, e.g. pulse width modulation [PWM]
- 2211/329 actuated by fluid pressure
- 2211/35 . . Directional control combined with flow control
- 2211/351 . . . Flow control by regulating means in feed line, i.e. meter-in control
- 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,
- 2211/41 . . characterised by the positions of the valve element
- 2211/411 . . . the positions being discrete
- 2211/413 . . . the positions being continuously variable, e.g. as realised by proportional valves
- 2211/415 . . characterised by the connections of the flow control means in the circuit
- 2211/41509 . . . being connected to a pressure source and a directional control valve
- 2211/41518 being connected to multiple pressure sources
- 2211/41527 . . . being connected to an output member and a directional control valve
- 2211/41536 being connected to multiple ports of an output member
- 2211/41545 being connected to multiple output members
- 2211/41554 . . . being connected to a return line and a directional control valve
- 2211/41563 . . . being connected to a pressure source and a return line
- 2211/41572 . . . being connected to a pressure source and an output member
- 2211/41581 . . . being connected to an output member and a return line
- 2211/4159 . . . being connected to a pressure source, an output member and a return line
- 2211/42 . . characterised by the type of actuation
- 2211/421 mechanically
- 2211/422 actuated by biasing means, e.g. spring-actuated
- 2211/423 manually, e.g. by using a lever or pedal
- 2211/424 actuated by an output member of the circuit
- 2211/425 with follow-up action
- 2211/426 electrically or electronically
- 2211/427 with signal modulation, e.g. using pulse width modulation [PWM]
- 2211/428 actuated by fluid pressure
- 2211/45 . . Control of bleed-off flow, e.g. control of bypass flow to the return line
- 2211/455 . . Control of flow in the feed line, i.e. meter-in control
- 2211/46 . . Control of flow in the return line, i.e. meter-out control
- 2211/465 . . Flow control with pressure compensation
- 2211/47 . . Flow control in one direction only
- 2211/473 . . . without restriction in the reverse direction
- 2211/476 . . . the flow in the reverse direction being blocked
- 2211/50 . Pressure control
- 2211/505 . . characterised by the type of pressure control means
- 2211/50509 . . . the pressure control means controlling a pressure upstream of the pressure control means
- 2211/50518 using pressure relief valves
- 2211/50527 using cross-pressure relief valves

- 2211/50536 using unloading valves controlling the supply pressure by diverting fluid to the return line
- 2211/50545 using braking valves to maintain a back pressure
- 2211/50554 . . . the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve
- 2211/50563 . . . the pressure control means controlling a differential pressure
- 2211/50572 using a pressure compensating valve for controlling the pressure difference across a flow control valve
- 2211/50581 using counterbalance valves
- 2211/5059 using double counterbalance valves
- 2211/51 . . characterised by the positions of the valve element
- 2211/511 . . . the positions being discrete
- 2211/513 . . . the positions being continuously variable, e.g. as realised by proportional valves
- 2211/515 . . characterised by the connections of the pressure control means in the circuit
- 2211/5151 . . . being connected to a pressure source and a directional control valve
- 2211/5152 being connected to multiple pressure sources
- 2211/5153 . . . being connected to an output member and a directional control valve
- 2211/5154 being connected to multiple ports of an output member
- 2211/5155 being connected to multiple output members
- 2211/5156 . . . being connected to a return line and a directional control valve
- 2211/5157 . . . being connected to a pressure source and a return line
- 2211/5158 . . . being connected to a pressure source and an output member
- 2211/5159 . . . being connected to an output member and a return line
- 2211/52 . . characterised by the type of actuation
- 2211/521 . . . mechanically
- 2211/522 actuated by biasing means, e.g. spring-actuated
- 2211/523 manually, e.g. by using a lever or pedal
- 2211/524 actuated by an output member of the circuit
- 2211/525 with follow-up action
- 2211/526 . . . electrically or electronically
- 2211/527 with signal modulation, e.g. pulse width modulation [PWM]
- 2211/528 . . . actuated by fluid pressure
- 2211/55 . . for limiting a pressure up to a maximum pressure, e.g. by using a pressure relief valve
- 2211/555 . . for assuring a minimum pressure, e.g. by using a back pressure valve
- 2211/56 . . Control of an upstream pressure
- 2211/565 . . Control of a downstream pressure
- 2211/57 . . Control of a differential pressure
- 2211/575 . . Pilot pressure control
- 2211/5753 . . . for closing a valve
- 2211/5756 . . . for opening a valve
- 2211/60 . . Circuit components or control therefor
- 2211/605 . . Load sensing circuits
- 2211/6051 . . . having valve means between output member and the load sensing circuit
- 2211/6052 using check valves
- 2211/6054 using shuttle valves
- 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
- 2211/625 . . Accumulators
- 2211/63 . . Electronic controllers
- 2211/6303 . . . using input signals
- 2211/6306 representing a pressure
- 2211/6309 the pressure being a pressure source supply pressure
- 2211/6313 the pressure being a load pressure
- 2211/6316 the pressure being a pilot pressure
- 2211/632 representing a flow rate
- 2211/6323 the flow rate being a pressure source flow rate
- 2211/6326 the flow rate being an output member flow rate
- 2211/633 representing a state of the prime mover, e.g. torque or rotational speed
- 2211/6333 representing a state of the pressure source, e.g. swash plate angle
- 2211/6336 representing a state of the output member, e.g. position, speed or acceleration
- 2211/634 representing a state of a valve
- 2211/6343 representing a temperature
- 2211/6346 representing a state of input means, e.g. joystick position
- 2211/635 . . Circuits providing pilot pressure to pilot pressure-controlled fluid circuit elements
- 2211/6355 . . . having valve means
- 2211/65 . . Methods of control of the load sensing pressure
- 2211/651 . . . characterised by the way the load pressure is communicated to the load sensing circuit
- 2211/652 . . . the load sensing pressure being different from the load pressure
- 2211/653 . . . the load sensing pressure being higher than the load pressure
- 2211/654 . . . the load sensing pressure being lower than the load pressure
- 2211/655 . . Methods of contamination control, i.e. methods of control of the cleanliness of circuit components or of the pressure fluid
- 2211/66 . . Temperature control methods
- 2211/665 . . Methods of control using electronic components
- 2211/6651 . . . Control of the prime mover, e.g. control of the output torque or rotational speed
- 2211/6652 . . . Control of the pressure source, e.g. control of the swash plate angle
- 2211/6653 . . . Pressure control
- 2211/6654 . . . Flow rate control
- 2211/6655 . . . Power control, e.g. combined pressure and flow rate control
- 2211/6656 . . . Closed loop control, i.e. control using feedback
- 2211/6657 . . . Open loop control, i.e. control without feedback
- 2211/6658 . . . Control using different modes, e.g. four-quadrant-operation, working mode and transportation mode

- 2211/67 . . Methods for controlling pilot pressure
- 2211/70 . Output members, e.g. hydraulic motors or cylinders or control therefor
- 2211/705 . . characterised by the type of output members or actuators
- 2211/7051 . . . Linear output members
- 2211/7052 Single-acting output members
- 2211/7053 Double-acting output members
- 2211/7054 Having equal piston areas
- 2211/7055 having more than two chambers
- 2211/7056 Tandem cylinders
- 2211/7057 being of the telescopic type
- 2211/7058 . . . Rotary output members
- 2211/71 . . Multiple output members, e.g. multiple hydraulic motors or cylinders
- 2211/7107 . . . the output members being mechanically linked
- 2211/7114 . . . with direct connection between the chambers of different actuators
- 2211/7121 the chambers being connected in series
- 2211/7128 the chambers being connected in parallel
- 2211/7135 . . . Combinations of output members of different types, e.g. single-acting cylinders with rotary motors
- 2211/7142 . . . the output members being arranged in multiple groups
- 2211/715 . . having braking means
- 2211/72 . . having locking means
- 2211/75 . . Control of speed of the output member
- 2211/755 . . Control of acceleration or deceleration of the output member
- 2211/76 . . Control of force or torque of the output member
- 2211/761 . . . Control of a negative load, i.e. of a load generating hydraulic energy
- 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
- 2211/765 . . Control of position or angle of the output member
- 2211/7653 . . . at distinct positions, e.g. at the end position
- 2211/7656 . . . with continuous position control
- 2211/77 . . Control of direction of movement of the output member
- 2211/7708 . . . in one direction only
- 2211/7716 . . . with automatic return
- 2211/7725 . . . with automatic reciprocation
- 2211/7733 . . . providing vibrating movement, e.g. dither control for emptying a bucket
- 2211/7741 . . . with floating mode, e.g. using a direct connection between both lines of a double-acting cylinder
- 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
- 2211/78 . . Control of multiple output members
- 2211/781 . . . one or more output members having priority
- 2211/782 . . . Concurrent control, e.g. synchronisation of two or more actuators
- 2211/783 . . . Sequential control
- 2211/785 . . Compensation of the difference in flow rate in closed fluid circuits using differential actuators
- 2211/80 . . Other types of control related to particular problems or conditions
- 2211/85 . . Control during special operating conditions
- 2211/851 . . . during starting
- 2211/853 . . . during stopping
- 2211/855 . . Testing of fluid pressure systems
- 2211/857 . . Monitoring of fluid pressure systems
- 2211/86 . . Control during or prevention of abnormal conditions
- 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