

# CPC COOPERATIVE PATENT CLASSIFICATION

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

### ENGINEERING IN GENERAL

## F15 FLUID-PRESSURE ACTUATORS; HYDRAULICS OR PNEUMATICS IN GENERAL

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

### NOTE

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

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

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

- 1/02 . Installations or systems with accumulators
- 1/021 . . {used for damping}
- 1/022 . . {used as an emergency power source, e.g. in case of pump failure}
- 1/024 . . {used as a supplementary power source, e.g. to store energy in idle periods to balance pump load}
- 1/025 . . {used for thermal compensation, e.g. to collect expanded fluid and to return it to the system as the system fluid cools down}
- 1/027 . . having accumulator charging devices
- 1/0275 . . . {with two or more pilot valves, e.g. for independent setting of the cut-in and cut-out pressures}
- 1/033 . . . with electrical control means
- 1/04 . . Accumulators
- 1/045 . . . {Dead weight accumulators}
- 1/08 . . . using a gas cushion; Gas charging devices; Indicators or floats therefor
- 1/083 . . . . {the accumulator having a fusible plug}
- 1/086 . . . . {the gas cushion being entirely enclosed by the separating means, e.g. foam or gas-filled balls}
- 1/10 . . . . with flexible separating means
- 1/103 . . . . . {the separating means being bellows}
- 1/106 . . . . . {characterised by the way housing components are assembled}
- 1/12 . . . . . attached at their periphery (flexible separating means in the form of a tube [F15B 1/16](#))
- 1/125 . . . . . . {characterised by the attachment means ([F15B 1/14](#) takes precedence)}
- 1/14 . . . . . by means of a rigid annular supporting member
- 1/16 . . . . . in the form of a tube
- 1/165 . . . . . . {in the form of a bladder}
- 1/18 . . . . . Anti-extrusion means

- 1/20 . . . . . fixed to the separating means
- 1/22 . . . . Liquid port constructions
- 1/24 . . . . with rigid separating means, e.g. pistons
- 1/26 . Supply reservoir or sump assemblies
- 1/265 . . {with pressurised main reservoir}

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

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

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

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

### NOTE

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

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

- 7/001 . {With multiple inputs, e.g. for dual control}
- 7/003 . {with multiple outputs}
- 7/005 . {With rotary or crank input}
- 7/006 . . {Rotary pump input}
- 7/008 . {with rotary output}

7/02	• Systems with continuously-operating input and output apparatus	11/036	• • • by means of servomotors having a plurality of working chambers
7/04	• In which the ratio between pump stroke and motor stroke varies with the resistance against the motor	11/0365	• • • • {Tandem constructions}
7/06	• Details (F15B 15/00 takes precedence)	11/04	• • for controlling the speed (F15B 11/024 takes precedence)
7/08	• • Input units; Master units	11/0406	• • • {during starting or stopping (F15B 11/048 takes precedence)}
7/10	• • Compensation of the liquid content in a system (F15B 7/08 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}
<b>9/00</b>	<b>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</b>	11/042	• • • by means in the feed line {, i.e. "meter in"} (F15B 11/046, F15B 11/05 take precedence)
9/02	• with servomotors of the reciprocable or oscillatable type	11/0423	• • • • {by controlling pump output or bypass, other than to maintain constant speed}
9/03	• • with electrical control means {(F15B 9/07, F15B 9/09, F15B 9/17 take precedence)}	11/0426	• • • • {by controlling the number of pumps or parallel valves switched on}
9/04	• • controlled by varying the output of a pump with variable capacity	11/044	• • • by means in the return line {, i.e. "meter out"} (F15B 11/046, F15B 11/05 take precedence)
9/06	• • controlled by means using a fluid jet	11/0445	• • • • {with counterbalance valves, e.g. to prevent overrunning or for braking}
9/07	• • • with electrical control means	11/046	• • • depending on the position of the working member
9/08	• • controlled by valves affecting the fluid feed or the fluid outlet of the servomotor (F15B 9/06 takes precedence)	11/048	• • • • with deceleration control
9/09	• • • with electrical control means	11/05	• • • specially adapted to maintain constant speed, e.g. pressure-compensated, load-responsive {(F15B 11/161 takes precedence)}
9/10	• • • in which the controlling element and the servomotor each controls a separate member, these members influencing different fluid passages or the same passage	11/055	• • • • {by adjusting the pump output or bypass}
9/12	• • • in which both the controlling element and the servomotor control the same member influencing a fluid passage and are connected to that member by means of a differential gearing	11/06	• involving features specific to the use of a compressible medium, e.g. air, steam
9/14	• with rotary servomotors	11/064	• • with devices for saving the compressible medium
9/16	• Systems essentially having two or more interacting servomotors {, e.g. multi-stage (F15B 18/00, F15B 20/00 take precedence)}	11/068	• • with valves for gradually putting pneumatic systems under pressure
9/17	• • with electrical control means	11/072	• • Combined pneumatic-hydraulic systems (F15B 11/032 takes precedence)
<b>11/00</b>	<b>Servomotor systems without provision for follow-up action; {Circuits therefor} (F15B 3/00 takes precedence)</b>	11/0725	• • • {with the driving energy being derived from a pneumatic system, a subsequent hydraulic system displacing or controlling the output element}
11/003	• {Systems with load-holding valves}	11/076	• • • with pneumatic drive or displacement and speed control or stopping by hydraulic braking
11/006	• {Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link}	11/08	• with only one servomotor
11/02	• Systems essentially incorporating special features for controlling the speed or actuating force of an output member	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}
11/022	• • {in which a rapid approach stroke is followed by a slower, high-force working stroke (F15B 11/0325 takes precedence)}	11/12	• • providing distinct intermediate positions; with step-by-step action
11/024	• • by means of differential connection of the servomotor lines, e.g. regenerative circuits	11/121	• • • {providing distinct intermediate positions (F15B 11/13 takes precedence)}
2011/0243	• • • {the regenerative circuit being activated or deactivated automatically}	11/122	• • • • {by means of actuators with multiple stops}
2011/0246	• • • {with variable regeneration flow}	11/123	• • • • {by means of actuators with fluid-operated stops}
11/028	• • for controlling the actuating force (F15B 11/024 takes precedence)	11/125	• • • • {by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes}
11/032	• • • by means of fluid-pressure converters	11/126	• • • • {by means of actuators of the standard type with special circuit controlling means (F15B 11/125 takes precedence)}
11/0325	• • • • {the fluid-pressure converter increasing the working force after an approach stroke}	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	13/0401	. . . { Valve members; Fluid interconnections therefor}
11/15	. . with special provision for automatic return	13/0402	. . . {for linearly sliding valves, e.g. spool valves}
11/16	. with two or more servomotors	13/0403	. . . . {a secondary valve member sliding within the main spool, e.g. for regeneration flow (F15B 13/0418 takes precedence)}
11/161	. . {with sensing of servomotor demand or load}	13/0405	. . . . {for seat valves, i.e. poppet valves}
11/162	. . . {for giving priority to particular servomotors or users}	13/0406	. . . . {for rotary valves}
11/163	. . . {for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation}	13/0407	. . . . {Means for damping the valve member movement}
11/165	. . . {for adjusting the pump output or bypass in response to demand}	2013/0409	. . . . {Position sensing or feedback of the valve member}
11/166	. . . {Controlling a pilot pressure in response to the load, i.e. supply to at least one user is regulated by adjusting either the system pilot pressure or one or more of the individual pilot command pressures}	2013/041	. . . . {with two positions}
11/167	. . . {using pilot pressure to sense the demand}	2013/0412	. . . . {with three positions}
11/168	. . . {with an isolator valve (duplicating valve), i.e. at least one load sense [LS] pressure is derived from a work port load sense pressure but is not a work port pressure itself}	2013/0413	. . . . {with four or more positions}
11/17	. . using two or more pumps	2013/0414	. . . . {Dosing devices}
11/18	. . used in combination for obtaining stepwise operation of a single controlled member	13/0416	. . . {with means or adapted for load sensing}
11/183	. . . {Linear stepwise operation}	13/0417	. . . . {Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves}
11/186	. . . {Rotary stepwise operation}	13/0418	. . . . {Load sensing elements sliding within a hollow main valve spool}
11/20	. . controlling several interacting or sequentially-operating members	13/042	. . . operated by fluid pressure {(F15B 13/0401, F15B 13/0416 take precedence)}
11/205	. . . {the position of the actuator controlling the fluid flow to the subsequent actuator}	13/0422	. . . . {with manually-operated pilot valves, e.g. joysticks}
11/22	. . Synchronisation of the movement of two or more servomotors	13/0424	. . . . {the joysticks being provided with electrical switches or sensors}
<b>13/00</b>	<b>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}</b>	13/0426	. . . . {with fluid-operated pilot valves, i.e. multiple stage valves}
2013/002	. {Modular valves, i.e. consisting of an assembly of interchangeable components}	2013/0428	. . . . {with switchable internal or external pilot pressure source}
2013/004	. . {Cartridge valves}	13/043	. . . . with electrically-controlled pilot valves
2013/006	. . {Modular components with multiple uses, e.g. kits for either normally-open or normally-closed valves, interchangeable or reprogrammable manifolds}	13/0431	. . . . {the electrical control resulting in an on-off function}
2013/008	. {Throttling member profiles}	13/0433	. . . . {the pilot valves being pressure control valves (F15B 13/0435, F15B 13/0436, F15B 13/0438 take precedence)}
13/01	. Locking-valves or other detent {i.e. load-holding} devices	13/0435	. . . . {the pilot valves being sliding valves}
13/015	. . {using an enclosed pilot flow valve}	13/0436	. . . . {the pilot valves being of the steerable jet type}
13/02	. Fluid distribution or supply devices characterised by their adaptation to the control of servomotors	13/0438	. . . . {the pilot valves being of the nozzle-flapper type}
13/021	. . {Valves for interconnecting the fluid chambers of an actuator}	13/044	. . . operated by electrically-controlled means, e.g. solenoids, torque-motors
13/022	. . {Flow-dividers; Priority valves}	13/0442	. . . . {with proportional solenoid allowing stable intermediate positions}
13/023	. . {Excess flow valves, e.g. for locking cylinders in case of hose burst}	13/0444	. . . . {with rotary electric motor}
13/024	. . {Pressure relief valves}	13/0446	. . . . {with moving coil, e.g. voice coil}
13/025	. . {Pressure reducing valves}	2013/0448	. . . . {Actuation by solenoid and permanent magnet}
13/026	. . {Pressure compensating valves}	13/06	. . for use with two or more servomotors
13/027	. . {Check valves}	13/07	. . . in distinct sequence
13/028	. . {Shuttle valves}	13/08	. . . Assemblies of units, each for the control of a single servomotor only
13/029	. . {Counterbalance valves}	13/0803	. . . . {Modular units}
13/04	. . for use with a single servomotor	13/0807	. . . . {Manifolds}
		13/081	. . . . . {Laminated constructions}
		13/0814	. . . . . {Monoblock manifolds}
		13/0817	. . . . . {Multiblock manifolds}
		13/0821	. . . . . {Attachment or sealing of modular units to each other}

13/0825	. . . . . {the modular elements being mounted on a common member, e.g. on a rail}	15/103	. . . {using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators}
13/0828	. . . . . {characterised by sealing means of the modular units}	15/106	. . . {the motor being of the pinching-roller type}
13/0832	. . . . . {Modular valves}	15/12	. . of the oscillating-vane or curved-cylinder type
13/0835	. . . . . {Cartridge type valves}	15/125	. . . {of the curved-cylinder type}
13/0839	. . . . . {Stacked plate type valves}	15/14	. . of the straight-cylinder type
13/0842	. . . . . {Monoblock type valves, e.g. with multiple valve spools in a common housing}	15/1404	. . . {in clusters, e.g. multiple cylinders in one block}
13/0846	. . . . . {Electrical details}	15/1409	. . . {with two or more independently movable working pistons}
13/085	. . . . . {Electrical controllers}	15/1414	. . . {with non-rotatable piston}
13/0853	. . . . . {Electric circuit boards}	15/1419	. . . . {of non-circular cross-section}
13/0857	. . . . . {Electrical connecting means, e.g. plugs, sockets}	15/1423	. . . {Component parts; Constructional details}
13/086	. . . . . {Sensing means, e.g. pressure sensors}	15/1428	. . . . {Cylinders ( <a href="#">F15B 15/1438</a> takes precedence)}
13/0864	. . . . . {Signalling means, e.g. LEDs}	15/1433	. . . . {End caps ( <a href="#">F15B 15/1438</a> takes precedence)}
13/0867	. . . . . {Data bus systems}	15/1438	. . . . {Cylinder to end cap assemblies}
13/0871	. . . . . {Channels for fluid}	15/1442	. . . . . {End cap sealings}
13/0875	. . . . . {Channels for electrical components, e.g. for cables or sensors}	15/1447	. . . . {Pistons; Piston to piston rod assemblies}
13/0878	. . . . . {Assembly of modular units}	15/1452	. . . . . {Piston sealings}
13/0882	. . . . . {using identical modular elements}	15/1457	. . . . {Piston rods ( <a href="#">F15B 15/1447</a> takes precedence)}
13/0885	. . . . . {using valves combined with other components}	15/1461	. . . . . {Piston rod sealings}
13/0889	. . . . . {Valves combined with electrical components}	15/1466	. . . . {Hollow piston sliding over a stationary rod inside the cylinder}
13/0892	. . . . . {Valves combined with fluid components}	15/1471	. . . . {Guiding means other than in the end cap ( <a href="#">F15B 15/1466</a> takes precedence)}
13/0896	. . . . . {using different types or sizes of valves}	15/1476	. . . . {Special return means}
13/10	. Special arrangements for operating the actuated device {with or} without using fluid pressure, e.g. for emergency use	15/148	. . . . {Lost-motion means between the piston and the output}
13/12	. Special measures for increasing the sensitivity of the system	15/1485	. . . . {Special measures for cooling or heating}
13/14	. Special measures for giving the operating person a "feeling" of the response of the actuated device	15/149	. . . {Fluid interconnections, e.g. fluid connectors, passages}
13/16	. Special measures for feedback {, e.g. by a follow-up device}	2015/1495	. . . {with screw mechanism attached to the piston}
<b>15/00</b>	<b>Fluid-actuated devices for displacing a member from one position to another; Gearing associated therewith</b>	15/16	. . . of the telescopic type
15/02	. Mechanical layout characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member	15/165	. . . . {with synchronisation of sections}
15/04	. . with oscillating cylinder	15/17	. . . of differential-piston type
15/06	. . for mechanically converting rectilinear movement into non- rectilinear movement	15/18	. Combined units comprising both motor and pump
15/061	. . . {by unidirectional means}	15/19	. Pyrotechnical actuators
15/063	. . . {Actuator having both linear and rotary output, i.e. dual action actuator}	15/20	. Other details {, e.g. assembly with regulating devices}
15/065	. . . {the motor being of the rack-and-pinion type}	15/202	. . {Externally-operated valves mounted in or on the actuator}
15/066	. . . {the motor being of the scotch yoke type}	15/204	. . {Control means for piston speed or actuating force without external control, e.g. control valve inside the piston ( <a href="#">F15B 11/02</a> , <a href="#">F15B 15/22</a> take precedence)}
15/068	. . . {the motor being of the helical type}	2015/206	. . {Combined actuation, e.g. electric and fluid actuated}
15/08	. Characterised by the construction of the motor unit	2015/208	. . {Special fluid pressurisation means, e.g. thermal or electrolytic}
15/082	. . {the motor being of the slotted cylinder type}	15/22	. . for accelerating or decelerating the stroke
15/084	. . {the motor being of the rodless piston type, e.g. with cable, belt or chain}	15/221	. . . {for accelerating the stroke, e.g. by area increase}
15/086	. . . {with magnetic coupling}	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}
15/088	. . {the motor using combined actuation, e.g. electric and fluid actuation}	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}
15/10	. . the motor being of diaphragm type		



15/224	. . . {having a piston which closes off fluid outlets in the cylinder bore by its own movement}	20/002	. {Electrical failure}
15/225	. . . {with valve stems operated by contact with the piston end face or with the cylinder wall}	20/004	. {Fluid pressure supply failure}
15/226	. . . {having elastic elements, e.g. springs, rubber pads}	20/005	. {Leakage; Spillage; Hose burst}
15/227	. . . {having an auxiliary cushioning piston within the main piston or the cylinder end face}	20/007	. {Overload}
15/228	. . . {having shock absorbers mounted outside the actuator housing}	20/008	. {Valve failure}
15/24	. . for restricting the stroke	<b>21/00</b>	<b>Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass</b>
15/26	. . Locking mechanisms	21/001	. {Servomotor systems with fluidic control}
15/261	. . . {using positive interengagement, e.g. balls and grooves, for locking in the end positions}	21/003	. {Systems with different interchangeable components, e.g. using preassembled kits}
15/262	. . . {using friction, e.g. brake pads}	21/005	. {Filling or draining of fluid systems}
15/264	. . . . {Screw mechanisms attached to the piston}	21/006	. {Compensation or avoidance of ambient pressure variation}
15/265	. . . {specially adapted for rodless pistons or slotted cylinders}	21/008	. {Reduction of noise or vibration}
2015/267	. . . {Manual locking or release}	21/02	. Servomotor systems with program control derived from a store or timing device; Control devices therefor
2015/268	. . . {Fluid supply for locking or release independent of actuator pressurisation}	21/04	. Special measures taken in connection with the properties of the fluid
15/28	. . Means for indicating the position, e.g. end of stroke	21/041	. . Removal or measurement of solid or liquid contamination, e.g. filtering
15/2807	. . . {Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches}	21/042	. . Controlling the temperature of the fluid
15/2815	. . . {Position sensing, i.e. means for continuous measurement of position, e.g. LVDT}	21/0423	. . . Cooling
15/2823	. . . . {by a screw mechanism attached to the piston}	21/0427	. . . Heating
15/283	. . . . {using a cable wrapped on a drum and attached to the piston}	21/044	. . Removal or measurement of undissolved gas, e.g. de-aeration, venting or bleeding
15/2838	. . . . {with out using position sensors, e.g. by volume flow measurement or pump speed}	21/045	. . Compensating for variations in viscosity or temperature
15/2846	. . . . {using detection of markings, e.g. markings on the piston rod}	21/047	. . Preventing foaming, churning or cavitation
15/2853	. . . . {using potentiometers}	21/048	. . Arrangements for compressed air preparation, e.g. comprising air driers, air condensers, filters, lubricators or pressure regulators
15/2861	. . . . {using magnetic means}	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
15/2869	. . . . {using electromagnetic radiation, e.g. radar or microwaves}	21/065	. . {Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid}
15/2876	. . . . . {using optical means, e.g. laser}	21/08	. Servomotor systems incorporating electrically operated control means ( <a href="#">F15B 21/02</a> , <a href="#">F15B 21/065</a> take precedence)
15/2884	. . . . . {using sound, e.g. ultrasound}	21/082	. . {with different modes}
15/2892	. . . {characterised by the attachment means}	21/085	. . {using a data bus, e.g. "CANBUS"}
<b>17/00</b>	<b>Combinations of telemotor and servomotor systems</b>	21/087	. . {Control strategy, e.g. with block diagram}
17/02	. in which a telemotor operates the control member of a servomotor	21/10	. Delay devices or arrangements
<b>18/00</b>	<b>Parallel arrangements of independent servomotor systems</b>	21/12	. Fluid oscillators or pulse generators
<b>19/00</b>	<b>Testing; {Calibrating; Fault detection or monitoring; Simulation or modelling of} fluid-pressure systems or apparatus not otherwise provided for</b>	21/125	. . {by means of a rotating valve}
19/002	. {Calibrating}	21/14	. Energy-recuperation means
19/005	. {Fault detection or monitoring}	<b>2201/00</b>	<b>Accumulators</b>
19/007	. {Simulation or modelling}	2201/20	. Accumulator cushioning means
<b>20/00</b>	<b>Safety arrangements for fluid actuator systems; Applications of safety devices in fluid actuator systems; Emergency measures for fluid actuator systems</b>	2201/205	. . using gas
20/001	. {Double valve requiring the use of both hands simultaneously}	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	2211/216	. . . the pressure sources being pneumatic-to-hydraulic converters
2201/3154	. . . the flexible separating means being completely enclosed, e.g. using gas-filled balls or foam	2211/218	. . . the pressure sources being pyrotechnical charges
2201/3155	. . . characterised by the material of the flexible separating means	2211/25	. . Pressure control functions
2201/3156	. . . characterised by their attachment	2211/251	. . . High pressure control
2201/3157	. . . Sealings for the flexible separating means	2211/252	. . . Low pressure control
2201/3158	. . . Guides for the flexible separating means, e.g. for a collapsed bladder	2211/253	. . . Pressure margin control, e.g. pump pressure in relation to load pressure
2201/32	. . having multiple separating means, e.g. with an auxiliary piston sliding within a main piston, multiple membranes or combinations thereof	2211/255	. . Flow control functions
2201/40	. Constructional details of accumulators not otherwise provided for	2211/26	. . Power control functions
2201/405	. . Housings	2211/265	. . Control of multiple pressure sources
2201/4053	. . . characterised by the material	2211/2652	. . . without priority
2201/4056	. . . characterised by the attachment of housing components	2211/2654	. . . one or more pressure sources having priority
2201/41	. . Liquid ports	2211/2656	. . . by control of the pumps
2201/411	. . . having valve means	2211/2658	. . . by control of the prime movers
2201/413	. . . having multiple liquid ports	2211/27	. . Directional control by means of the pressure source
2201/415	. . Gas ports	2211/275	. . Control of the prime mover, e.g. hydraulic control
2201/4155	. . . having valve means	2211/30	. Directional control
2201/42	. . Heat recuperators for isothermal compression and expansion	2211/305	. . characterised by the type of valves
2201/43	. . Anti-extrusion means	2211/30505	. . . Non-return valves, i.e. check valves
2201/435	. . . being fixed to the separating means	2211/3051	. . . . Cross-check valves
2201/50	. Monitoring, detection and testing means for accumulators	2211/30515	. . . . Load holding valves
2201/505	. . Testing of accumulators, e.g. for testing tightness	2211/3052	. . . Shuttle valves
2201/51	. . Pressure detection	2211/30525	. . . Directional control valves, e.g. 4/3-directional control valve
2201/515	. . Position detection for separating means	2211/3053	. . . . In combination with a pressure compensating valve
2201/60	. Assembling or methods for making accumulators	2211/30535	. . . . . the pressure compensating valve is arranged between pressure source and directional control valve
2201/605	. . Assembling or methods for making housings therefor	2211/3054	. . . . . the pressure compensating valve is arranged between directional control valve and output member
2201/61	. . Assembling or methods for making separating means therefor	2211/30545	. . . . . the pressure compensating valve is arranged between output member and directional control valve
2201/615	. . Assembling or methods for making ports therefor	2211/3055	. . . . . the pressure compensating valve is arranged between directional control valve and return line
<b>2211/00</b>	<b>Circuits for servomotor systems</b>	2211/30555	. . . . . Inlet and outlet of the pressure compensating valve being connected to the directional control valve
2211/20	. Fluid pressure source, e.g. accumulator or variable axial piston pump	2211/3056	. . . Assemblies of multiple valves
2211/205	. . Systems with pumps	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
2211/20507	. . . Type of prime mover	2211/3057	. . . . . having two valves, one for each port of a double-acting output member
2211/20515	. . . . Electric motor	2211/30575	. . . . . in a Wheatstone Bridge arrangement (also half bridges)
2211/20523	. . . . Internal combustion engine	2211/3058	. . . . . having additional valves for interconnecting the fluid chambers of a double-acting actuator, e.g. for regeneration mode or for floating mode
2211/2053	. . . Type of pump	2211/30585	. . . . . having a single valve for multiple output members
2211/20538	. . . . constant capacity	2211/3059	. . . . . having multiple valves for multiple output members
2211/20546	. . . . variable capacity	2211/30595	. . . . . with additional valves between the groups of valves for multiple output members
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		

2211/31	. . characterised by the positions of the valve element	2211/351	. . . Flow control by regulating means in feed line, i.e. meter-in control
2211/3105	. . . Neutral or centre positions	2211/353	. . . Flow control by regulating means in return line, i.e. meter-out control
2211/3111	. . . . the pump port being closed in the centre position, e.g. so-called closed centre	2211/355	. . Pilot pressure control
2211/3116	. . . . the pump port being open in the centre position, e.g. so-called open centre	2211/36	. . Pilot pressure sensing
2211/3122	. . . Special positions other than the pump port being connected to working ports or the working ports being connected to the return line	2211/365	. . Directional control combined with flow control and pressure control
2211/3127	. . . . Floating position connecting the working ports and the return line	2211/40	. Flow control
2211/3133	. . . . Regenerative position connecting the working ports or connecting the working ports to the pump, e.g. for high-speed approach stroke	2211/405	. . characterised by the type of flow control means or valve
2211/3138	. . . the positions being discrete	2211/40507	. . . with constant throttles or orifices
2211/3144	. . . the positions being continuously variable, e.g. as realised by proportional valves	2211/40515	. . . with variable throttles or orifices
2211/315	. . characterised by the connections of the valve or valves in the circuit	2211/40523	. . . with flow dividers
2211/31505	. . . being connected to a pressure source and a return line	2211/4053	. . . . using valves
2211/31511	. . . . having a single pressure source	2211/40538	. . . . using volumetric pumps or motors
2211/31517	. . . . having multiple pressure sources	2211/40546	. . . with flow combiners
2211/31523	. . . being connected to a pressure source and an output member	2211/40553	. . . with pressure compensating valves
2211/31529	. . . . having a single pressure source and a single output member	2211/40561	. . . . the pressure compensating valve arranged upstream of the flow control means
2211/31535	. . . . having multiple pressure sources and a single output member	2211/40569	. . . . the pressure compensating valve arranged downstream of the flow control means
2211/31541	. . . . having a single pressure source and multiple output members	2211/40576	. . . Assemblies of multiple valves
2211/31547	. . . . having multiple pressure sources and multiple output members	2211/40584	. . . . the flow control means arranged in parallel with a check valve
2211/31552	. . . being connected to an output member and a return line	2211/40592	. . . . with multiple valves in parallel flow paths,
2211/31558	. . . . having a single output member	2211/41	. . characterised by the positions of the valve element
2211/31564	. . . . having multiple output members	2211/411	. . . the positions being discrete
2211/3157	. . . being connected to a pressure source, an output member and a return line	2211/413	. . . the positions being continuously variable, e.g. as realised by proportional valves
2211/31576	. . . . having a single pressure source and a single output member	2211/415	. . characterised by the connections of the flow control means in the circuit
2211/31582	. . . . having multiple pressure sources and a single output member	2211/41509	. . . being connected to a pressure source and a directional control valve
2211/31588	. . . . having a single pressure source and multiple output members	2211/41518	. . . . being connected to multiple pressure sources
2211/31594	. . . . having multiple pressure sources and multiple output members	2211/41527	. . . being connected to an output member and a directional control valve
2211/32	. . characterised by the type of actuation	2211/41536	. . . . being connected to multiple ports of an output member
2211/321	. . . mechanically	2211/41545	. . . . being connected to multiple output members
2211/322	. . . . actuated by biasing means, e.g. spring-actuated	2211/41554	. . . being connected to a return line and a directional control valve
2211/323	. . . . . the biasing means being adjustable	2211/41563	. . . being connected to a pressure source and a return line
2211/324	. . . . manually, e.g. by using a lever or pedal	2211/41572	. . . being connected to a pressure source and an output member
2211/325	. . . . actuated by an output member of the circuit	2211/41581	. . . being connected to an output member and a return line
2211/326	. . . . . with follow-up action	2211/4159	. . . being connected to a pressure source, an output member and a return line
2211/327	. . . electrically or electronically	2211/42	. . characterised by the type of actuation
2211/328	. . . . with signal modulation, e.g. pulse width modulation [PWM]	2211/421	. . . mechanically
2211/329	. . . actuated by fluid pressure	2211/422	. . . . actuated by biasing means, e.g. spring-actuated
2211/35	. . Directional control combined with flow control	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	2211/527	. . . . with signal modulation, e.g. pulse width modulation [PWM]
2211/455	. . Control of flow in the feed line, i.e. meter-in control	2211/528	. . . . actuated by fluid pressure
2211/46	. . Control of flow in the return line, i.e. meter-out control	2211/55	. . for limiting a pressure up to a maximum pressure, e.g. by using a pressure relief valve
2211/465	. . Flow control with pressure compensation	2211/555	. . for assuring a minimum pressure, e.g. by using a back pressure valve
2211/47	. . Flow control in one direction only	2211/56	. . Control of an upstream pressure
2211/473	. . . without restriction in the reverse direction	2211/565	. . Control of a downstream pressure
2211/476	. . . the flow in the reverse direction being blocked	2211/57	. . Control of a differential pressure
2211/50	. Pressure control	2211/575	. . Pilot pressure control
2211/505	. . characterised by the type of pressure control means	2211/5753	. . . for closing a valve
2211/50509	. . . the pressure control means controlling a pressure upstream of the pressure control means	2211/5756	. . . for opening a valve
2211/50518	. . . . using pressure relief valves	2211/60	. Circuit components or control therefor
2211/50527	. . . . using cross-pressure relief valves	2211/605	. . Load sensing circuits
2211/50536	. . . . using unloading valves controlling the supply pressure by diverting fluid to the return line	2211/6051	. . . having valve means between output member and the load sensing circuit
2211/50545	. . . . using braking valves to maintain a back pressure	2211/6052	. . . . using check valves
2211/50554	. . . the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve	2211/6054	. . . . using shuttle valves
2211/50563	. . . the pressure control means controlling a differential pressure	2211/6055	. . . . using pressure relief valves
2211/50572	. . . . using a pressure compensating valve for controlling the pressure difference across a flow control valve	2211/6057	. . . . using directional control valves
2211/50581	. . . . using counterbalance valves	2211/6058	. . . with isolator valves
2211/5059	. . . . using double counterbalance valves	2211/61	. . Secondary circuits
2211/51	. . characterised by the positions of the valve element	2211/611	. . . Diverting circuits, e.g. for cooling or filtering
2211/511	. . . the positions being discrete	2211/613	. . . Feeding circuits
2211/513	. . . the positions being continuously variable, e.g. as realised by proportional valves	2211/615	. . Filtering means
2211/515	. . characterised by the connections of the pressure control means in the circuit	2211/62	. . Cooling or heating means
2211/5151	. . . being connected to a pressure source and a directional control valve	2211/625	. . Accumulators
2211/5152	. . . . being connected to multiple pressure sources	2211/63	. . Electronic controllers
2211/5153	. . . being connected to an output member and a directional control valve	2211/6303	. . . using input signals
2211/5154	. . . . being connected to multiple ports of an output member	2211/6306	. . . . representing a pressure
2211/5155	. . . . being connected to multiple output members	2211/6309	. . . . the pressure being a pressure source supply pressure
2211/5156	. . . being connected to a return line and a directional control valve	2211/6313	. . . . the pressure being a load pressure
2211/5157	. . . being connected to a pressure source and a return line	2211/6316	. . . . the pressure being a pilot pressure
2211/5158	. . . being connected to a pressure source and an output member	2211/632	. . . . representing a flow rate
2211/5159	. . . being connected to an output member and a return line	2211/6323	. . . . the flow rate being a pressure source flow rate
2211/52	. . characterised by the type of actuation	2211/6326	. . . . the flow rate being an output member flow rate
2211/521	. . . mechanically	2211/633	. . . . representing a state of the prime mover, e.g. torque or rotational speed
2211/522	. . . . actuated by biasing means, e.g. spring-actuated	2211/6333	. . . . representing a state of the pressure source, e.g. swash plate angle
2211/523	. . . . manually, e.g. by using a lever or pedal	2211/6336	. . . . representing a state of the output member, e.g. position, speed or acceleration
2211/524	. . . . actuated by an output member of the circuit	2211/634	. . . . representing a state of a valve
2211/525	. . . . with follow-up action	2211/6343	. . . . representing a temperature
2211/526	. . . electrically or electronically	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