

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}
9/00	Servomotors with follow-up action, {e.g. obtained by feed-back control,} i.e. in which the position of the actuated member conforms with that of the controlling member	11/042	• • • by means in the feed line (F15B 11/046, F15B 11/05 take precedence)
9/02	• with servomotors of the reciprocable or oscillable 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 (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 (F15B 11/165 takes precedence)}
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
		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
11/00	Servomotor systems without provision for follow-up action {; Circuits therefor}(F15B 3/00 takes precedence)	11/10	• • in which the servomotor position is a function of the pressure {; Pressure regulators as operating means therefor}
11/003	• {Systems with load-holding valves}	11/12	• • providing distinct intermediate positions; with step-by-step action
11/006	• {Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link}	11/121	• • • {providing distinct intermediate positions}
11/02	• Systems essentially incorporating special features for controlling the speed or the actuating force of an output member	11/122	• • • • {by means of actuators with multiple stops}
11/022	• • {in which a rapid approach stroke is followed by a slower, high-force working stroke (F15B 11/0325 takes precedence)}	11/123	• • • • {by means of actuators with fluid-operated stops}
11/024	• • by means of differential connection of the servomotor lines, e.g. regenerative circuits	11/125	• • • • {by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes}
2011/0243	• • • {the regenerative circuit being activated or deactivated automatically}	11/126	• • • • {by means of actuators of the standard type with special circuit controlling means (F15B 11/125 takes precedence)}
2011/0246	• • • {with variable regeneration flow}	11/127	• • • • {with step-by-step action}
11/028	• • for controlling the actuating force (F15B 11/024 takes precedence)	11/128	• • • • {by means of actuators of the standard type with special circuit controlling means}
11/032	• • • by means of fluid-pressure converters	11/13	• • • using {separate dosing} chambers of predetermined volume
11/0325	• • • • {the fluid-pressure converter increasing the working force after an approach stroke}	11/15	• • with special provision for automatic return
		11/16	• with two or more servomotors
		11/161	• • {with sensing of servomotor demand or load}

11/162	. . . {for giving priority to particular servomotors or users}	13/0405	. . . . {for seat valves, i.e. poppet valves}
11/163	. . . {for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation}	13/0406	. . . . {for rotary valves}
11/165	. . . {for adjusting the pump output or bypass in response to demand}	13/0407	. . . . {Means for damping the valve member movement}
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}	2013/0409	. . . . {Position sensing or feedback of the valve member}
11/167	. . . {using pilot pressure to sense the demand}	2013/041	. . . . {with two positions}
11/168	. . . {with at least one load sense pressure being derived from a work port load pressure but not being the work port load pressure itself}	2013/0412	. . . . {with three positions}
11/17	. . using two or more pumps	2013/0413	. . . . {with four or more positions}
11/18	. . used in combination for obtaining stepwise operation of a single controlled member	2013/0414	. . . . {Dosing devices}
11/183	. . . {Linear stepwise operation}	13/0416	. . . {with means or adapted for load sensing}
11/186	. . . {Rotary stepwise operation}	13/0417	. . . . {Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves}
11/20	. . controlling several interacting or sequentially-operating members	13/0418	. . . . . {Load sensing elements sliding within a hollow main valve spool}
11/205	. . . {the position of the actuator controlling the fluid flow to the subsequent actuator}	13/042	. . . operated by fluid pressure {(F15B 13/0401, F15B 13/0416 take precedence)}
11/22	. . Synchronisation of the movement of two or more servomotors	13/0422	. . . . {with manually-operated pilot valves, e.g. joysticks}
13/00	Details of servomotor systems ((F15B 1/04, F15B 1/26, F15B 3/00, F15B 7/08, F15B 11/02, F15B 11/10,) F15B 15/00 take precedence); Valves for servomotor systems	13/0424	. . . . . {the joysticks being provided with electrical switches or sensors}
2013/002	. {Modular valves, i.e. consisting of an assembly of interchangeable components}	13/0426	. . . . {with fluid-operated pilot valves, i.e. multiple stage valves}
2013/004	. . {Cartridge valves}	2013/0428	. . . . {with switchable internal or external pilot pressure source}
2013/006	. . {Modular components with multiple uses, e.g. kits for either normally-open or normally-closed valves, interchangeable or reprogrammable manifolds}	13/043	. . . . with electrically-controlled pilot valves
2013/008	. {Throttling member profiles}	13/0431	. . . . . {the electrical control resulting in an on-off function}
13/01	. Locking-valves or other detent {i.e. load-holding} devices	13/0433	. . . . . {the pilot valves being pressure control valves (F15B 13/0435, F15B 13/0436, F15B 13/0438 take precedence) }
13/015	. . {using an enclosed pilot flow valve}	13/0435	. . . . . {the pilot valves being sliding valves}
13/02	. Fluid distribution or supply devices characterised by their adaptation to the control of servomotors	13/0436	. . . . . {the pilot valves being of the steerable jet type}
13/021	. . {Valves for interconnecting the fluid chambers of an actuator}	13/0438	. . . . . {the pilot valves being of the nozzle-flapper type}
13/022	. . {Flow-dividers; Priority valves}	13/044	. . . operated by electrically-controlled means, e.g. solenoids, torque-motors
13/023	. . {Excess flow valves, e.g. for locking cylinders in case of hose burst}	13/0442	. . . . {with proportional solenoid allowing stable intermediate positions}
13/024	. . {Pressure relief valves}	13/0444	. . . . {with rotary electric motor}
13/025	. . {Pressure reducing valves}	13/0446	. . . . {with moving coil, e.g. voice coil}
13/026	. . {Pressure compensating valves}	2013/0448	. . . . {Actuation by solenoid and permanent magnet}
13/027	. . {Check valves}	13/06	. . for use with two or more servomotors
13/028	. . {Shuttle valves}	13/07	. . . in distinct sequence
13/029	. . {Counterbalance valves}	13/08	. . . Assemblies of units, each for the control of a single servomotor only
13/04	. . for use with a single servomotor	13/0803	. . . . {Modular units}
13/0401	. . . {Valve members; Fluid interconnections therefor}	13/0807	. . . . . {Manifolds}
13/0402	. . . . {for linearly sliding valves, e.g. spool valves}	13/081	. . . . . {Laminated constructions}
13/0403	. . . . . {a secondary valve member sliding within the main spool, e.g. for regeneration flow (F15B 13/0418 takes precedence) }	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}
		13/0828	. . . . . {characterised by sealing means of the modular units}
		13/0832	. . . . . {Modular valves}
		13/0835	. . . . . {Cartridge type valves}
		13/0839	. . . . . {Stacked plate type valves}

- 13/0842 {Monoblock type valves, e.g. with multiple valve spools in a common housing}
- 13/0846 {Electrical details}
- 13/085 {Electrical controllers}
- 13/0853 {Electric circuit boards}
- 13/0857 {Electrical connecting means, e.g. plugs, sockets}
- 13/086 {Sensing means, e.g. pressure sensors}
- 13/0864 {Signalling means, e.g. LEDs}
- 13/0867 {Data bus systems}
- 13/0871 {Channels for fluid}
- 13/0875 {Channels for electrical components, e.g. for cables or sensors}
- 13/0878 {Assembly of modular units}
- 13/0882 {using identical modular elements}
- 13/0885 {using valves combined with other components}
- 13/0889 {Valves combined with electrical components}
- 13/0892 {Valves combined with fluid components}
- 13/0896 {using different types or sizes of valves}
- 13/10 Special arrangements for operating the actuated device {with or} without using fluid pressure, e.g. for emergency use
- 13/12 Special measures for increasing the sensitivity of the system
- 13/14 Special measures for giving the operating person a "feeling" of the response of the actuated device
- 13/16 Special measures for feedback {, e.g. by a follow-up device}
- 15/00 Fluid-actuated devices for displacing a member from one position to another; 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}
- 15/066 {the motor being of the scotch yoke type}
- 15/068 {the motor being of the helical type}
- 15/08 Characterised by the construction of the motor unit
- 15/082 {the motor being of the slotted cylinder type}
- 15/084 {the motor being of the rodless piston type, e.g. with cable, belt or chain}
- 15/086 {with magnetic coupling}
- 15/088 {the motor using combined actuation, e.g. electric and fluid actuation}
- 15/10 the motor being of diaphragm type
- 15/103 {using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators}
- 15/106 {the motor being of the pinching-roller type}
- 15/12 of the oscillating-vane or curved-cylinder type
- 15/125 {of the curved-cylinder type}
- 15/14 of the straight-cylinder type
- 15/1404 {in clusters, e.g. multiple cylinders in one block}
- 15/1409 {with two or more independently movable working pistons}
- 15/1414 {with non-rotatable piston}
- 15/1419 {of non-circular cross-section}
- 15/1423 {Component parts; Constructional details}
- 15/1428 {Cylinders [\(F15B 15/1438 takes precedence\)](#)}
- 15/1433 {End caps [\(F15B 15/1438 takes precedence\)](#)}
- 15/1438 {Cylinder to end cap assemblies}
- 15/1442 {End cap sealings}
- 15/1447 {Pistons; Piston to piston rod assemblies}
- 15/1452 {Piston sealings}
- 15/1457 {Piston rods [\(F15B 15/1447 takes precedence\)](#)}
- 15/1461 {Piston rod sealings}
- 15/1466 {Hollow piston sliding over a stationary rod inside the cylinder}
- 15/1471 {Guiding means other than in the end cap [\(F15B 15/1466 takes precedence\)](#)}
- 15/1476 {Special return means}
- 15/148 {Lost-motion means between the piston and the output}
- 15/1485 {Special measures for cooling or heating}
- 15/149 {Fluid interconnections, e.g. fluid connectors, passages}
- 2015/1495 {with screw mechanism attached to the piston}
- 15/16 of the telescopic type
- 15/165 {with synchronisation of sections}
- 15/17 of differential-piston type
- 15/18 Combined units comprising both motor and pump
- 15/19 Pyrotechnical actuators
- 15/20 Other details {, e.g. assembly with regulating devices}
- 15/202 {Externally-operated valves mounted in or on the actuator}
- 15/204 {Control means for piston speed or actuating force without external control, e.g. control valve inside the piston [\(F15B 11/02, F15B 15/22 take precedence\)](#)}
- 2015/206 {Combined actuation, e.g. electric and fluid actuated}
- 2015/208 {Special fluid pressurisation means, e.g. thermal or electrolytic}
- 15/22 for accelerating or decelerating the stroke
- 15/221 {for accelerating the stroke, e.g. by area increase}
- 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}
- 15/223 {having a piston with a piston extension or piston recess which completely seals the main fluid outlet as the piston approaches its end position}
- 15/224 {having a piston which closes off fluid outlets in the cylinder bore by its own movement}
- 15/225 {with valve stems operated by contact with the piston end face or with the cylinder wall}
- 15/226 {having elastic elements, e.g. springs, rubber pads}

15/227	. . . {having an auxiliary cushioning piston within the main piston or the cylinder end face}	21/00	Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass
15/228	. . . {having shock absorbers mounted outside the actuator housing}	21/001	. {Servomotor systems with fluidic control}
15/24	. . for restricting the stroke	21/003	. {Systems with different interchangeable components, e.g. using preassembled kits}
15/26	. . Locking mechanisms	21/005	. {Filling or draining of fluid systems}
15/261	. . . {using positive interengagement, e.g. balls and grooves, for locking in the end positions}	21/006	. {Compensation or avoidance of ambient pressure variation}
15/262	. . . {using friction, e.g. brake pads}	21/008	. {Reduction of noise or vibration}
15/264	. . . . {Screw mechanisms attached to the piston}	21/02	. Servomotor systems with program control derived from a store or timing device; Control devices therefor
15/265	. . . {specially adapted for rodless pistons or slotted cylinders}	21/04	. Special measures taken in connection with the properties of the fluid
2015/267	. . . {Manual locking or release}	21/041	. . Removal or measurement of solid or liquid contamination, e.g. filtering
2015/268	. . . {Fluid supply for locking or release independent of actuator pressurisation}	21/042	. . Controlling the temperature of the fluid
15/28	. . Means for indicating the position, e.g. end of stroke	21/0423	. . . Cooling
15/2807	. . . {Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches}	21/0427	. . . Heating
15/2815	. . . {Position sensing, i.e. means for continuous measurement of position, e.g. LVDT}	21/044	. . Removal or measurement of undissolved gas, e.g. de-aeration, venting or bleeding
15/2823	. . . . {by a screw mechanism attached to the piston}	21/045	. . Compensating for variations in viscosity or temperature
15/283	. . . . {using a cable wrapped on a drum and attached to the piston}	21/047	. . Preventing foaming, churning or cavitation
15/2838	. . . . {with out using position sensors, e.g. by volume flow measurement or pump speed}	21/048	. . Arrangements for compressed air preparation, e.g. comprising air driers, air condensers, filters, lubricators or pressure regulators
15/2846	. . . . {using detection of markings, e.g. markings on the piston rod}	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
15/2853	. . . . {using potentiometers}	21/065	. . {Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid}
15/2861	. . . . {using magnetic means}	21/08	. Servomotor systems incorporating electrically operated control means (F15B 21/02 , F15B 21/065 take precedence)
15/2869	. . . . {using electromagnetic radiation, e.g. radar or microwaves}	21/082	. . {with different modes}
15/2876	. . . . . {using optical means, e.g. laser}	21/085	. . {using a data bus, e.g. "CANBUS"}
15/2884	. . . . {using sound, e.g. ultrasound}	21/087	. . {Control strategy, e.g. with block diagram}
15/2892	. . . {characterised by the attachment means}	21/10	. Delay devices or arrangements
17/00	Combinations of telemotor and servomotor systems	21/12	. Fluid oscillators or pulse generators
17/02	. in which a telemotor operates the control member of a servomotor	21/125	. . {by means of a rotating valve}
18/00	Parallel arrangements of independent servomotor systems	21/14	. Energy-recuperation means
19/00	Testing; {Calibrating; Fault detection or monitoring; Simulation or modelling of} fluid-pressure systems or apparatus not otherwise provided for	2201/00	Accumulators
19/002	. {Calibrating}	2201/20	. Accumulator cushioning means
19/005	. {Fault detection or monitoring}	2201/205	. . using gas
19/007	. {Simulation or modelling}	2201/21	. . using springs
20/00	Safety arrangements for fluid actuator systems; Applications of safety devices in fluid actuator systems; Emergency measures for fluid actuator systems	2201/215	. . using weights
20/001	. {Double valve requiring the use of both hands simultaneously}	2201/22	. . using elastic housings
20/002	. {Electrical failure}	2201/30	. Accumulator separating means
20/004	. {Fluid pressure supply failure}	2201/305	. . without separating means
20/005	. {Leakage; Spillage; Hose burst}	2201/31	. . having rigid separating means, e.g. pistons
20/007	. {Overload}	2201/312	. . . Sealings therefor, e.g. piston rings
20/008	. {Valve failure}	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
- 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