**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.

<table>
<thead>
<tr>
<th>1/00</th>
<th>Installations or systems with accumulators; Supply reservoir or sump assemblies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/02</td>
<td>Installations or systems with accumulators</td>
</tr>
<tr>
<td>1/021</td>
<td>[used for damping]</td>
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<tr>
<td>1/022</td>
<td>[used as an emergency power source, e.g. in case of pump failure]</td>
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<tr>
<td>1/024</td>
<td>[used as a supplementary power source, e.g. to store energy in idle periods to balance pump load]</td>
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<tr>
<td>1/025</td>
<td>[used for thermal compensation, e.g. to collect expanded fluid and to return it to the system as the system fluid cools down]</td>
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<tr>
<td>1/027</td>
<td>having accumulator charging devices</td>
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<tr>
<td>1/0275</td>
<td>[with two or more pilot valves, e.g. for independent setting of the cut-in and cut-out pressures]</td>
</tr>
</tbody>
</table>

**WARNING**

Not complete, see F15B 1/027

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

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

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

| 5/00 | Transducers converting variations of physical quantities, e.g. expressed by variations in positions of members, into fluid-pressure variations or vice versa; Varying fluid pressure as a function of variations of a plurality of fluid pressures or variations of other quantities *(F15B 9/00 takes precedence)* |
| 5/003| {characterised by variation of the pressure in a nozzle or the like, e.g. nozzle-flapper system} |
| 5/006| {with electrical means, e.g. electropneumatic transducer *(F15B 5/003 takes precedence)*} |

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

**NOTE**

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

| 7/00 | Systems in which the movement produced is definitely related to the output of a volumetric pump; Telemotors |
Fluid-pressure actuator systems

**CPC - 2019.05**

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**F15B**

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
7/04 . . . In which the ratio between pump stroke and motor stroke varies with the resistance against the motor
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)

**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**

9/02 . . . with servomotors of the reciprocatable 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
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)]
9/17 . . . 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]
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 11/0225 takes precedence)]
11/024 . . . by means of differential connection of the servomotor lines, e.g. regenerative circuits
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
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
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]
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)
11/055 . . . [by adjusting the pump output or bypass]
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
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]

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<td>Details of servomotor systems</td>
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</table>
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]

**WARNING**
Not complete, see also F15B 15/08, F15B 2015/206
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]
Provided for pressure systems or apparatus not otherwise monitoring; Simulation or modelling of fluid flow.

Parallel arrangements of independent servomotor systems.

Servomotor systems with programme control.

Systems with different interchangeable components, e.g. using preassembled kits.

Compensation or avoidance of ambient pressure variation.

Servomotor systems with programme control derived from a store or timing device; Control devices therefor.

Special measures taken in connection with the properties of the fluid.

Servomotor systems with fluidic control.

Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass.

Methods for indicating the position, e.g. end of stroke.

Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches.

Screw mechanisms attached to the piston.

Specially adapted for rodless pistons or slotted cylinders.

Manual locking or release.

Fluid supply for locking or release independent of actuator pressurisation.

Means for indicating the position, e.g. end of stroke.

Position sensing, i.e. means for continuous measurement of position, e.g. LVDT.

(by a screw mechanism attached to the piston).

(using a cable wrapped on a drum and attached to the piston).

(with out using position sensors, e.g. by volume flow measurement or pump speed).

(using detection of markings, e.g. markings on the piston rod).

(using potentiometers).

(using magnetic means).

(using electromagnetic radiation, e.g. radar or microwaves).

(using optical means, e.g. laser).

(using sound, e.g. ultrasound).

(characterised by the attachment means).

Combinations of telemotor and servomotor systems.

in which a telemotor operates the control member of a servomotor.

Parallel arrangements of independent servomotor systems.

Testing; Calibrating; Fault detection or monitoring; Simulation or modelling of fluid pressure systems or apparatus not otherwise provided for.

Calibrating.

Fault detection or monitoring.

Safety arrangements for fluid actuator systems; Applications of safety devices in fluid actuator systems; Emergency measures for fluid actuator systems.

Double valve requiring the use of both hands simultaneously.

Electrical failure.

Fluid pressure supply failure.

Leakage; Spillage; Hose burst.

Overload.

Valve failure.

Common features of fluid actuator systems; Fluid-pressure actuator systems or details thereof, not covered by any other group of this subclass.

Servomotor systems with fluidic control.

Systems with different interchangeable components, e.g. using preassembled kits.

Filling or draining of fluid systems.

Servomotor systems with fluidic control.

Systems with different interchangeable components, e.g. using preassembled kits.

Systems with different interchangeable components, e.g. using preassembled kits.

Servomotor systems with programme control derived from a store or timing device; Control devices therefor.

Special measures taken in connection with the properties of the fluid.

Removal or measurement of solid or liquid contamination, e.g. filtering.

Controlling the temperature of the fluid.

WARNING

Group F15B 21/042 is impacted by reclassification into groups F15B 21/0423 and F15B 21/0427.

Group F15B 21/042, F15B 21/0423, and F15B 21/0427 should be considered in order to perform a complete search.

WARNING

Group F15B 21/0423 is incomplete pending reclassification of documents from group F15B 21/042.

Group F15B 21/042 and F15B 21/0423 should be considered in order to perform a complete search.

WARNING

Group F15B 21/0427 is incomplete pending reclassification of documents from group F15B 21/042.

Group F15B 21/042 and F15B 21/0427 should be considered in order to perform a complete search.

WARNING

Group F15B 21/0427 is incomplete pending reclassification of documents from group F15B 21/042.

Group F15B 21/042 and F15B 21/0427 should be considered in order to perform a complete search.
Accumulators

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

CPC - 2019.05  6
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,
Pressure control means characterised by the type of pressure control

Flow control in one direction only
Flow control with pressure compensation
Control of flow in the return line, i.e. meter-out
Control of flow in the feed line, i.e. meter-in
Control of bleed-off flow, e.g. control of bypass flow to the return line
Control of flow in the feed line, i.e. meter-out control
Flow control with pressure compensation
Flow control in one direction only
without restriction in the reverse direction
the flow in the reverse direction being blocked
Pressure control
characterised by the type of pressure control means

the pressure control means controlling a pressure upstream of the pressure control means
using pressure relief valves
using cross-pressure relief valves
using unloading valves controlling the supply pressure by diverting fluid to the return line
using braking valves to maintain a back pressure
the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve
the pressure control means controlling a differential pressure

using a pressure compensating valve for controlling the pressure difference across a flow control valve
using counterbalance valves
using double counterbalance valves
characterised by the positions of the valve element
the positions being discrete
the positions being continuously variable, e.g. as realised by proportional valves
characterised by the connections of the pressure control means in the circuit
being connected to multiple pressure sources
being connected to an output member and a directional control valve
being connected to multiple ports of an output member
being connected to multiple output members
being connected to a return line and a directional control valve
being connected to a pressure source and a return line
being connected to a pressure source and an output member
being connected to an output member and a directional control valve
being connected to multiple ports of an output member
being connected to multiple output members
being connected to a return line and a directional control valve
being connected to a pressure source and a return line
being connected to a pressure source and an output member
being connected to an output member and a directional control valve
characterised by the type of actuation
mechanically
actuated by biasing means, e.g. spring-actuated
manually, e.g. by using a lever or pedal
actuated by an output member of the circuit
with follow-up action
electrically or electronically
with signal modulation, e.g. using pulse width modulation [PWM]
actuated by fluid pressure
Control of bleed-off flow, e.g. control of bypass flow to the return line
Control of flow in the feed line, i.e. meter-in control
Control of flow in the return line, i.e. meter-out control
Flow control with pressure compensation
Flow control in one direction only
without restriction in the reverse direction
the flow in the reverse direction being blocked
Pressure control
characterised by the type of pressure control means
using pressure relief valves
using cross-pressure relief valves
using unloading valves controlling the supply pressure by diverting fluid to the return line
using braking valves to maintain a back pressure
the pressure control means controlling a pressure downstream of the pressure control means, e.g. pressure reducing valve
the pressure control means controlling a differential pressure

using check valves
using shuttle valves
using pressure relief valves
using directional control valves
with isolator valves
Secondary circuits
Diverting circuits, e.g. for cooling or filtering
Feeding circuits
Filtering means
Cooling or heating means
Accumulators

Electronic controllers

using input signals

representing a pressure

the pressure being a pressure source supply pressure

the pressure being a load pressure

the pressure being a pilot pressure

representing a flow rate

the flow rate being a pressure source flow rate

the flow rate being an output member flow rate

representing a state of the prime mover, e.g. torque or rotational speed

representing a state of the pressure source, e.g. swash plate angle

representing a state of the output member, e.g. position, speed or acceleration

representing a state of a valve

representing a temperature

representing a state of input means, e.g. joystick position

Circuits providing pilot pressure to pilot pressure-controlled fluid circuit elements

having valve means

Methods of control of the load sensing pressure

characterised by the way the load pressure is communicated to the load sensing circuit

the load sensing pressure being different from the load pressure

the load sensing pressure being higher than the load pressure

the load sensing pressure being lower than the load pressure

Methods of contamination control, i.e. methods of control of the cleanliness of circuit components or of the pressure fluid

Temperature control methods

Methods of control using electronic components

Control of the prime mover, e.g. control of the output torque or rotational speed

Control of the pressure source, e.g. control of the swash plate angle

Pressure control

Flow rate control

Power control, e.g. combined pressure and flow rate control

Closed loop control, i.e. control using feedback

Open loop control, i.e. control without feedback

Control using different modes, e.g. four-quadrant-operation, working mode and transportation mode

Methods for controlling pilot pressure

Output members, e.g. hydraulic motors or cylinders or control thereof

characterised by the type of output members or actuators

Linear output members

Single-acting output members

Double-acting output members

Having equal piston areas

having more than two chambers

Tandem cylinders

being of the telescopic type

Rotary output members

Multiple output members, e.g. multiple hydraulic motors or cylinders

the output members being mechanically linked

with direct connection between the chambers of different actuators

the chambers being connected in series

the chambers being connected in parallel

Combinations of output members of different types, e.g. single-acting cylinders with rotary motors

the output members being arranged in multiple groups

having braking means

having locking means

Control of speed of the output member

Control of acceleration or deceleration of the output member

Control of force or torque of the output member

Control of a negative load, i.e. of a load generating hydraulic energy

Control of torque of the output member by means of a variable capacity motor, i.e. by a secondary control on the motor

Control of position or angle of the output member

at distinct positions, e.g. at the end position

with continuous position control

Control of direction of movement of the output member

in one direction only

with automatic return

with automatic reciprocation

providing vibrating movement, e.g. dither control for emptying a bucket

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

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

Control of multiple output members

one or more output members having priority

Concurrent control, e.g. synchronisation of two or more actuators

Sequential control

Compensation of the difference in flow rate in closed fluid circuits using differential actuators

Other types of control related to particular problems or conditions

Control during special operating conditions

during starting

during stopping

Testing of fluid pressure systems

Monitoring of fluid pressure systems

Control during or prevention of abnormal conditions

the abnormal condition being an obstacle

the abnormal condition being a shock

the abnormal condition being cavitation
the abnormal condition being oscillations
the abnormal condition being noise or vibration
the abnormal condition being electric or electronic failure
Electric supply failure
Electronic controller failure, e.g. software, EMV, electromagnetic interference
the abnormal condition being a hydraulic or pneumatic failure
Pressure source supply failure
Circuit failure, e.g. valve or hose failure
Failure of an output member, e.g. actuator or motor failure
the abnormal condition being a human failure
the abnormal condition being hysteresis
Prevention of failures
Detection of failures
Control measures for coping with failures
Emergency operation mode, e.g. fail-safe operation mode
Emergency shut-down
using redundant components or assemblies
Control measures for saving energy
Control specific to the type of fluid, e.g. specific to magnetorheological fluid
Compressible fluids, e.g. specific to pneumatics
Control specific for achieving vacuum or "negative pressure"
Manual override

Fluid-actuated devices for displacing a member from one position to another
Constructional details thereof
characterised by the use of special materials