(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 752 739 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
09.03.2022 Bulletin 2022/10

(21) Application number: **19712013.2**

(22) Date of filing: **11.02.2019**

(51) International Patent Classification (IPC):
F15B 11/044 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F15B 11/0445; B66F 9/0655; B66F 9/22;
F15B 11/22; F15B 20/005; F15B 2211/50545;
F15B 2211/50554; F15B 2211/50581;
F15B 2211/5153; F15B 2211/575; F15B 2211/6313;
F15B 2211/6355; F15B 2211/7053;
F15B 2211/7128; F15B 2211/782; (Cont.)

(86) International application number:
PCT/IB2019/000015

(87) International publication number:
WO 2019/158989 (22.08.2019 Gazette 2019/34)

(54) **APPARATUS FOR REGULATING THE STROKE OF DOUBLE-ACTING HYDRAULIC ACTUATORS**

VORRICHTUNG ZUR REGELUNG DES HUBS VON DOPPELTWIRKENDEN HYDRAULISCHEN AKTUATOREN

APPAREIL DE RÉGULATION DE LA COURSE D'ACTIONNEURS HYDRAULIQUES À DOUBLE EFFET

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **15.02.2018 IT 201800002731**

(43) Date of publication of application:
23.12.2020 Bulletin 2020/52

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WO-A1-2016/200272
US-A1- 2013 298 541

Printed by Jouve, 75001 PARIS (FR)

(Cont. next page)

(52) Cooperative Patent Classification (CPC): (Cont.)
F15B 2211/8606; F15B 2211/8613;
F15B 2211/8636

Description

[0001] The object of the present invention is an apparatus for regulating the stroke of double-acting hydraulic actuators for the hydraulic actuation of manoeuvring means of operating machines.

[0002] In the prior art, each of these hydraulic actuators, consisting of double-acting hydraulic cylinders, is individually equipped, for safety reasons, with its own shut-off valve, which is fastened to the cylinder itself with the specific task of ensuring, in the event that a hydraulic hose gets broken, the sealing of the cylinder, preventing it from emptying and dropping the operating element and the load applied thereto.

[0003] To achieve a certain precision and linearity in the descent of an device such as a hoisting arm of an operating machine driven by a double-acting cylinder, a hydraulic over-center valve is normally provided, through which pressure is given to the stem side of the cylinder and the bottom side is opened in order to lower the arm in safety. With this solution, however, essentially because it uses a hydraulic-mechanical valve, at the time of opening during the descent phase, a more or less abrupt movement occurs, depending on the settings, that is gradually more extended as the loads involved increase.

[0004] Furthermore, especially for large operating machines using large hoisting arms operated by big cylinders and subjected to their own weight and that of the heavy loads, an actual hopping is caused during lowering due to occurrence of a sudden drop in pressure on the stem side (because the hydraulic liquid supplied to the chamber on the stem side by the distributor is insufficient to fill the volume necessary to keep the chamber under pressure) and this causes the momentary closure of the shut-off valve with consequent stopping of the arm lowering. Lowering, however, resumes immediately after giving rise to a succession of operation steps in rapid succession of the shut-off valve (hopping) until the cylinder on the stem side is restored to operating pressure.

[0005] To solve this problem, the use of a hydraulic accumulator is known, which is specifically designed to feed the chamber on the stem side and keep it under pressure throughout the lowering stroke.

[0006] However, the known technique has the disadvantage of causing a certain functional and constructive complication in the bottom sides. This is in particular evident when two or more hydraulic actuators work together to hydraulically actuate operating machine parts. WO 2016/200272 A1 discloses a known apparatus for regulating the stroke of a double-acting hydraulic actuator.

[0007] Object of the present invention is to limit the disadvantages and drawbacks of the prior art while maintaining high safety standards, in accordance with what is described, illustrated and claimed below. Another object of the invention is to synchronize the pressures and make them uniform at every point of the circuit of two or more hydraulic actuators that collaborate together coupled to the hydraulic operation of manoeuvring and lifting members mounted onto operating machines.

[0008] An advantage of the invention is that it has a relatively simple structure in terms of circuitry.

[0009] Additional features and advantages will result more evident from the following detailed description of some preferred, but not exclusive, embodiments of the invention, herein illustrated by way of example only in the attached figures, in which: ,

- Figure 1 shows a schematic side view in vertical elevation of a self-propelled operating machine equipped with a manoeuvring device consisting of a telescopic arm for the hydraulic lifting of which a double-acting hydraulic actuator or cylinder is used;
- Figure 2 shows a schematic hydraulic layout of a first embodiment of the invention;
- Figure 3 shows a schematic hydraulic layout of a second embodiment of the invention;

[0010] With reference to the above mentioned Figures, numeral 1 indicates as a whole a self-propelled operating machine, made mobile on wheels 2, which is equipped with a manoeuvring member at the top, consisting of a telescopic hoisting arm 3, the movement of which is carried out by means of a double acting hydraulic actuator 4.

[0011] The hydraulic actuator 4 is nothing more than a double-acting hydraulic cylinder which is hinged with its bottom side 5 to the frame of the self-propelled operating machine 4 and, with its stem, to the telescopic hoisting arm 3.

[0012] The hydraulic actuator or double-acting hydraulic cylinder 4 is fed by a hydraulic control circuit, which is connected to a hydraulic distributor 7, from which a supply line 8 for feeding the bottom side 5 and a supply line 9 for feeding the stem side 6 originate.

[0013] A shut-off and regulation valve 10 is provided along the supply line 8 of the bottom side 5, with the function of intercepting and regulating the flow of fluid out coming, the valve being controlled by an electronic regulation valve 11.

[0014] This latter is operated by the signal originating from a pressure transducer 12 as a function of a pressure value measured at the stem side 6.

[0015] The electronic regulation valve 11 is adjusted to intervene on the shut-off valve 10 in order to control and increase its opening when the pressure of the stem side 6, reported by the pressure transducer 12, reaches a preset minimum value and to open the valve up to reaching a pressure at stem side 6 having a predetermined value.

[0016] If the pressure on the stem side falls down, the opening of valve 10, controlled by the electronic control valve 11, is reduced (when the movement stops it is completely closed), so as to maintain the pressure on the stem side 6 within a pre-established "balancing" pressure range.

[0017] The electronic regulation valve 11 is controlled

by the value of the pressure on the stem side 6 through interposition of a pressure reducing valve 13.

[0018] Of course, starting operation of the electronic control valve 11 is determined by its necessary adjustment, with which the minimum and maximum values that define the range of action of the "balancing" pressure have been set in advance.

[0019] Therefore, during the lowering step, i.e. the return of the stem, the actual pressure, as reduced by the reducing valve 13, which is detected at the rod side 6 of the double-acting hydraulic cylinder 4, operates the shut-off valve 10.

[0020] In other words, the shut-off valve 10 is operated hydraulically through the interposition of the pressure reducing valve 13 and is modulated by the electronic control valve 11 which is a proportional valve.

[0021] The combination of the pressure reducing valve 13 and the electronic proportional control valve 11 is indicated by the acronym EVP, and hydraulically controls the shut-off valve 10 according to the methods described above.

[0022] In this way, all safety measures of the machine and the control of the lowering speed of the hoisting arm remain managed by the hydraulic distributor 7.

[0023] The action of the EVP system, including the electronic control valve 11, thus avoids the inconvenience of possible repeated closing of the shut-off valve 10, which would cause a kind of unwanted "hopping" of the telescopic hoisting arm 3 and the load it supports, thus allowing a continuous and shock-free lowering of the piston stem of the hydraulic actuator consisting of the double acting hydraulic cylinder 4.

[0024] This allows the oil pressure on the piston stem side 5 to be maintained within a set interval. This also allows achieving the result of smoothing the abrupt start of the movement, allowing instead gradual start and operation.

[0025] Operation is simple: when the operator gives the lowering command for the telescopic hoisting arm 3, the hydraulic distributor 7 is used to send oil to the chamber at the stem side 6 of the double acting hydraulic cylinder 4. The electronic control valve 11 operates in such a way that the pressure on the stem side 6 starts to rise, until a certain pre-set value is reached, when the shut-off valve 10 starts to open more and more under control by the electronic regulating valve 11 and hydraulically operated by the pressure on the stem side 6 through the reducing valve 13, so gradually lowering the telescopic hoisting arm 3.

[0026] As the opening increases, the lowering speed of the telescopic hoisting arm 3 increases progressively.

[0027] As soon as the lowering speed increases above a certain limit, the pressure on the stem side may decrease 6, which would cause the electronic control valve 11 to come into operation, which would command the shut-off valve 10 to reduce its opening, in order to keep the pressure on the stem side 6 within a predetermined minimum and maximum limit.

[0028] It will be appreciated that only the hydraulic distributor 7 always controls the lowering speed of the arm.

[0029] If, for any reason, the electronic control valve 11 is blocked, even if it is fully open, the telescopic hoisting arm 3 would never fall down, because without pressure on the stem side 6, which occurs only with the opening of the distributor and therefore with the consent of the operator, the shut-off valve 10 does not open mechanically. This means that all the safety features on the machine are not reduced or dropped.

[0030] According to a second embodiment of the invention, the movement of the telescopic hoisting arm 3 is carried out by means of two double-acting hydraulic actuators or hydraulic cylinders 4 equal to each other, which work together in conjunction with the hydraulic operation of the telescopic hoisting arm 3, both on lifting and lowering.

[0031] Each double acting hydraulic actuator or hydraulic cylinder 4 is served by a hydraulic control circuit, which is connected to the same hydraulic distributor 7 from which, for each of them, a supply line 8 for feeding the bottom side 5 and a supply line 9 for feeding the stem side 6 originate.

[0032] On each of the supply lines 8 to the bottom side 5 there is a shut-off valve 10 with the function of intercepting and regulating the flow coming out of the relative bottom side 5.

[0033] Each double acting hydraulic actuator or hydraulic cylinder 4 is fed by a hydraulic control circuit, connected to the same hydraulic distributor 7 from which, for each double-acting hydraulic actuator or hydraulic cylinder 4, the supply line 8 for feeding the bottom side 5 and supply line 9 for feeding the stem side 6 originate, as previously mentioned.

[0034] An electronic regulation valve 11 is operated by the signal originated by a pressure transducer 12 in accordance with a pressure value detected at the stem side 6 of the double-acting hydraulic actuators or hydraulic cylinders 4.

[0035] The electronic regulation valve 11 is adjusted to intervene on the shut-off valves 10 in order to control and increase their openings when the pressure of the stem side 6, reported by the pressure transducer 12, reaches a preset minimum value and to open the valves up to reaching pressures at stem side 6 having a predetermined value.

[0036] If the pressure on the stem side falls down, the opening of valve 10, controlled by the electronic control valve 11, is reduced (when the movement stops it is completely closed), so as to maintain the pressure on the stem side (6) within a pre-established "balancing" pressure range.

[0037] The electronic regulation valve 11 is adjusted to intervene on the shut-off valves 10 in order to control and increase their openings when the pressure of the stem side 6, reported by the pressure transducer 12, reaches a pre-set minimum threshold.

[0038] If the pressure on the stem side falls down, the

openings of valves 10, controlled by the electronic control valve 11, are reduced (when the movement stops they are completely closed), so as to maintain the pressure on the stem side within a pre-established "balancing" pressure range.

[0039] The electronic regulation valve 11 is controlled by the value of the pressure on the stem side 6 through interposition of a pressure reducing valve 13.

[0040] In other words, the electronic regulation valve 11 acts on the shut-off valves 10 so as to gradually increase their opening starting when the pressure at the stem side 6 reaches a preset minimum threshold, and to reduce, also gradually, the opening in case the pressure on the stem side is reduced, so as to maintain on the stem side a pre-set so called pressure "balancing" value.

[0041] Of course, starting operation of the electronic control valve 11 is determined by its necessary adjustment, with which the minimum and maximum values that define the range of action of the "balancing" pressure have been set in advance.

[0042] In other words, each shut-off valve 10 is operated by the value of the pressure at the side of the stem 6 through the interposition of a pressure reducing valve 13 and is modulated by the electronic control valve 11.

[0043] A connection 16 has been introduced between the chambers at the bottom sides 5 and a similar connection 17 has been inserted between the two chambers at the stem sides 6, which ensures stability and uniformity of pressures within the two chambers.

[0044] In particular, the electronic regulation valve 11 operates on both shut-off valves 10 in accordance with the methods previously illustrated, carrying out gradual interventions, without abrupt movements or shocks.

[0045] In this way, the two double-acting hydraulic cylinders 4 can be operated synchronously in a simple and effective manner.

[0046] Numeral 14 indicates the driving line connecting the second shut-off valve 10, operating on the bottom side 6, to the electronic regulation valve 11 of the second double-acting hydraulic actuator or hydraulic cylinder 4.

[0047] A parachute valve 15 is arranged and operates along the bottom side balancing line 16 of the two double-acting hydraulic actuators or hydraulic cylinders 4.

[0048] The parachute valves 15 operate in the same way on the bottom sides of the double acting hydraulic actuators or hydraulic cylinders 4, are connected to each other by a connection 16 and have the task of preventing both chambers from emptying in the event of a breakage of a pipe.

[0049] This allows the double acting hydraulic actuators or hydraulic cylinders 4 to work in synchronism, especially during the lowering step, guaranteeing the safety standards required by the regulations in force.

[0050] The modes of operation are basically those of the first illustrated embodiment characterized by the presence of a single double acting hydraulic actuator or hydraulic cylinder.

Claims

1. Apparatus for regulating the stroke of double-acting hydraulic actuators of the type used for hydraulic actuation of maneuvering members of operating machines, comprising double-acting hydraulic actuators or hydraulic cylinders (4), hydraulic control circuits, hydraulic distributors (7), pressure transducers (12), wherein each hydraulic control circuit comprises a shut-off valve (10), a pressure reducing valve (13) and an electronic regulation valve (11), wherein each single double-acting hydraulic actuator or hydraulic cylinder (4) is supplied by a hydraulic control circuit connected to a hydraulic distributor (7) from which a supply line (8) originates for feeding the bottom side (5) of the single double-acting hydraulic actuator or hydraulic cylinder (4) and a line (9) originates for feeding the stem side (6) of the single double-acting hydraulic actuator or hydraulic cylinder (4), wherein a shut-off valve (10) is provided on the supply line (8) to the bottom side (5) of the single double-acting hydraulic actuator or hydraulic cylinder (4) with the task of intercepting and regulating the outlet flow, wherein the shut-off valve (10) is hydraulically operated by the pressure value at the stem side (6) of the single double-acting hydraulic actuator or hydraulic cylinder (4) through interposition of a pressure reducing valve (13) and modulated by an electronic regulation valve (11) to which it is hydraulically connected; the apparatus further comprising operating means configured to operate the electronic regulation valve (11) in accordance with the signal originated by a pressure transducer (12) in accordance with a pressure value detected at the stem side (6) of the single double-acting hydraulic actuator or hydraulic cylinder (4), the electronic regulation valve (11) being operated in order to act on the shut-off valve (10) so as to control and increase opening thereof upon reaching a pressure of a predetermined minimum value at the stem side (6), and to increase the opening of the shut-off valve (10) until reaching a pressure of a predetermined maximum value at the stem side (6), the operating means being further configured such that when the pressure at the stem side (6) decreases, opening of the shut-off valve (10), controlled by the electronic regulation valve (11) is reduced, and in the event that the movement stops, the shut-off valve (10) closes completely, so as to maintain the pressure at the stem side (6) within a pre-established pressure range.

2. Apparatus according to claim 1, **characterized in that** the electronic regulation valve (11) is a proportional type one and acts on the shut-off valve (10) so as to gradually increase its opening starting from when the pressure at the stem side (6) reaches the predetermined minimum value.

3. Apparatus for regulating the stroke of double-acting hydraulic actuators of the type used for hydraulic actuation of maneuvering members of operating machines, comprising two or more double-acting hydraulic actuators or hydraulic cylinders (4), a hydraulic control circuit comprising shut-off valves (10), a pressure reducing valve (13) and an electronic regulation valve (11), a hydraulic distributor (7), a pressure transducer (12), wherein the two or more double-acting hydraulic actuators or hydraulic cylinders (4) are connected in parallel so as to cooperate together as a couple for said hydraulic actuation and each double-acting hydraulic actuator or hydraulic cylinder (4) is supplied by the hydraulic control circuit connected to the hydraulic distributor (7) from which supply lines (8) originate for feeding each bottom side (5) of the two or more double-acting hydraulic actuators or hydraulic cylinders (4) and lines (9) originate for feeding each stem side (6) of the two or more double-acting hydraulic actuators or hydraulic cylinders (4), wherein a shut-off valve is provided on each supply line (8) to the bottom side (5) with the task of intercepting the outlet flow wherein the shut-off valves (10) are all connected to the same electronic regulation valve (11), the apparatus further comprising operating means configured to operate the electronic regulation valve (11) in accordance with the signal originated by the pressure transducer (12) in accordance with a corresponding pressure value detected at the stem side (6) of one of the two or more hydraulic actuators or hydraulic cylinders (4) to operate the shut-off valves (10) so as to control and increase opening thereof upon reaching a pressure at the stem side reported by the pressure transducer (12) having a preset minimum value and up to reaching a pressure at stem side (6) having a predetermined maximum value; all the shut-off valves (10) being hydraulically operated by the pressure value at the stem side (6) of the one of the two or more hydraulic actuators or hydraulic cylinders (4) through the interposition of the pressure reducing valve (13) and the modulating action of the electronic regulation valve (11) to which the shut-off valves (10) are hydraulically connected, so as to maintain the pressure at the stem side (6) within a pre-established pressure range.

4. Apparatus according to claim 3, **characterized by** including a parachute valve (15) applied to the bottom side (6) of each double-acting hydraulic actuator or hydraulic cylinder (4), said parachute valves (15) operating in the same manner on the respective bottom sides of the double-acting hydraulic actuators or hydraulic cylinders and being hydraulically connected directly to one another by means of a hydraulic connection (16) having the task of balancing the pressure at the bottom sides of the double-acting hydraulic actuators or hydraulic cylinders (4).

Patentansprüche

1. Vorrichtung zur Regelung des Hubs von doppeltwirkenden hydraulischen Aktuatoren von der Art, die für den hydraulischen Antrieb von Manövriergliedern von Arbeitsmaschinen verwendet werden, die doppeltwirkende hydraulische Aktuatoren oder hydraulische Zylinder (4), hydraulische Steuerkreise, hydraulische Verteiler (7), Druckmesswertwandler (12) umfassen, wobei jede hydraulische Steuerschaltung ein Anlassventil (10), ein Druckminderventil (13) und ein elektronisches Regelventil (11) umfasst, wobei jeder einzelne doppeltwirkenden hydraulische Aktuator oder hydraulische Zylinder (4) von einer hydraulischen Steuerschaltung versorgt wird, die mit einem hydraulischen Verteiler (7) verbunden ist, aus dem eine Speiseleitung (8) zum Versorgen der Unterseite (5) des einzelnen doppeltwirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4) hervorgeht und eine Leitung (9) zum Versorgen der Schaftseite (6) des einzelnen doppeltwirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4) hervorgeht, wobei ein Anlassventil (10) an der Versorgungsseite (8) für die Unterseite (5), des einzelnen doppelt wirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4), mit dem Ziel des Unterbrechens und Regelns des Ausgangsstroms angebracht ist, wobei das Anlassventil (10) durch den Druckwert an der Schaftseite (6) des einzelnen doppeltwirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4), durch Zwischenschaltung eines Druckminderventils (13), hydraulisch betätigt und durch ein elektronisches Regelventil (11) moduliert wird, mit welchem es hydraulisch verbunden ist, wobei die Vorrichtung weiter Betätigungsmittel umfasst, die konfiguriert sind, um das elektronische Regelventil (11) entsprechend dem Signal zu betätigen, dass von einem Druckmesswertwandler (12) entsprechend einem Druckwert erzeugt wird, welcher an der Schaftseite (6) des einzelnen doppeltwirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4) erfasst wird, wobei das elektronische Regelventil (11) betätigt wird, um auf das Anlassventil (10) einzuwirken, um dessen Öffnung beim Erreichen eines Drucks mit vordefiniertem Mindestwert an der Schaftseite (6) zu steuern und zu vergrößern und das Öffnen des Anlassventils (10) bis zum Erreichen eines Drucks mit vordefiniertem Höchstwert an der Schaftseite (6) zu vergrößern, wobei die Betätigungsmittel weiter so konfiguriert sind, dass der Öffnungsvorgang des Anlassventils (10) der vom elektrischen Regelventil (11) gesteuert wird, reduziert wird, wenn der Druck auf der Schaftseite (6) abnimmt und im Falle eines Anhaltens der Bewegung das Anlassventil (10) sich vollständig schließt, um den Druck auf der Schaftseite (6) innerhalb eines voreingestellten Druckbereichs zu halten.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das elektronische Regelventil (11) ein Proportionalventil ist, dass auf das Anlassventil (10) wirkt, um dessen Öffnungsvorgang allmählich zu vergrößern, ausgehend von dem Zeitpunkt zu dem der Druck auf der Schaftseite (6) den vordefinierten Mindestwert erreicht.

3. Vorrichtung zum Regeln des Hubs doppeltwirkender hydraulischer Aktuatoren, von der Art, die für den hydraulischen Antrieb von Manövriergliedern von Arbeitsmaschinen verwendet werden, Folgendes umfassend:
zwei oder mehr doppeltwirkende hydraulische Aktuatoren, oder hydraulische Zylinder (4), eine hydraulische Steuerschaltung, die Anlassventile (10), ein Druckminderventil (13) und ein elektronisches Regelventil (11) umfasst, einen hydraulischen Verteiler (7), einen Druckmesswertwandler (12), wobei die zwei oder mehr doppeltwirkenden hydraulischen Aktuatoren oder hydraulischen Zylinder (4) parallel geschaltet sind, um als ein Paar für den hydraulischen Antrieb zusammenzuwirken und jeder doppeltwirkende hydraulische Aktuator oder hydraulische Zylinder (4) von der hydraulischen Steuerschaltung versorgt wird, die mit dem hydraulischen Verteiler (7) verbunden ist, von dem Speiseleitungen (8) ausgehen, zur Versorgung jeder Unterseite (5) der zwei oder mehr doppeltwirkenden hydraulischen Aktuatoren oder hydraulischen Zylinder (4) und Leitungen (9) zur Speisung jeder Schaftseite (6) der zwei oder mehr doppeltwirkenden hydraulischen Aktuatoren oder hydraulischen Zylinder (4) ausgehen, wobei ein Anlassventil an jeder Speiseleitung (8) für die Unterseite (5) bereitgestellt ist, mit dem Ziel den Ausgangsstrom zu unterbrechen, wobei alle Anlassventile (10) mit demselben elektronischen Regelventil (11) verbunden sind, wobei die Vorrichtung weiter Betätigungsmittel umfasst, die konfiguriert sind, um das elektronische Regelventil (11) entsprechend dem Signal zu betätigen, dass vom Druckmesswertwandler (12) in Übereinstimmung mit einem entsprechenden Druckwert erzeugt wird, welches auf der Schaftseite (6) eines der zwei oder mehr hydraulischen Aktuatoren oder hydraulischen Zylinder (4) erfasst wird, um die Anlassventile (10) zu betätigen, um deren Öffnungsvorgang zu steuern und zu vergrößern, wenn ein von dem Druckmesswertwandler (12) auf der Schaftseite gemeldeter Druck einen vordefinierten Mindestwert erreicht hat und bis ein Druck auf der Schaftseite (6) einen vordefinierten Höchstwert erreicht hat, wobei alle Anlassventile (10) hydraulisch durch den Druckwert auf der Schaftseite (6) des einen oder der zwei oder mehr hydraulischen Aktuatoren oder hydraulischen Zylinder (4) betätigt werden, durch Zwischenschaltung des Druckminderventils (13) und die modulierende Wirkung des elektronischen Regelventils (11), mit dem die Anlassventile (10) hydraulisch verbunden sind, um den Druck auf der Schaftseite (6) innerhalb eines voreingestellten Druckbereichs zu halten.

4. Vorrichtung gemäß Anspruch 3, **gekennzeichnet durch** das Einschließen eines Rückschlagventils (15), dass an der Unterseite (6) jedes doppeltwirkenden hydraulischen Aktuators oder hydraulischen Zylinders (4) angebracht wird, wobei die Rückschlagventile (15) auf dieselbe Art auf die jeweiligen Unterseiten der doppeltwirkenden hydraulischen Aktuatoren oder hydraulischen Zylinder einwirken und über eine hydraulische Verbindung (16), hydraulisch direkt miteinander verbunden sind, die die Aufgabe hat, den Druck an den Unterseiten der doppeltwirkenden hydraulischen Aktuatoren oder hydraulischen Zylinder (4) auszugleichen.

Revendications

1. Appareil de régulation de la course d'actionneurs hydrauliques à double effet du type utilisé pour l'actionnement hydraulique d'organes de manœuvre de machines de travail, comprenant des actionneurs hydrauliques ou vérins hydrauliques à double effet (4), des circuits de commande hydraulique, des distributeurs hydrauliques (7), des capteurs de pression (12), dans lequel chaque circuit de commande hydraulique comprend une vanne d'isolement (10), un détendeur de pression (13) et une vanne de régulation électronique (11), dans lequel chaque actionneur hydraulique ou vérin hydraulique à double effet individuel (4) est alimenté par un circuit de commande hydraulique relié à un distributeur hydraulique (7) d'où part une conduite d'alimentation (8) pour alimenter le côté inférieur (5) de l'actionneur hydraulique ou vérin hydraulique à double effet individuel (4) et d'où part une conduite (9) pour alimenter le côté tige (6) de l'actionneur hydraulique ou vérin hydraulique à double effet individuel (4), dans lequel une vanne d'isolement (10) est placée sur la conduite d'alimentation (8) du côté inférieur (5) de l'actionneur hydraulique ou vérin hydraulique à double effet individuel (4), laquelle a pour but d'intercepter et de réguler le flux de sortie, dans lequel la vanne d'isolement (10) est actionnée hydrauliquement par la valeur de pression du côté tige (6) de l'actionneur hydraulique ou vérin hydraulique à double effet individuel (4) par l'intermédiaire d'un détendeur de pression (13) et modulée par une vanne de régulation électronique (11) à laquelle elle est hydrauliquement reliée ; l'appareil comprenant en outre un moyen d'activation configuré pour faire fonctionner la vanne de régulation électronique (11) selon le signal émis par un capteur de pression (12) selon une valeur de pression détectée côté tige (6) de l'actionneur hydraulique ou vérin hydraulique à double effet

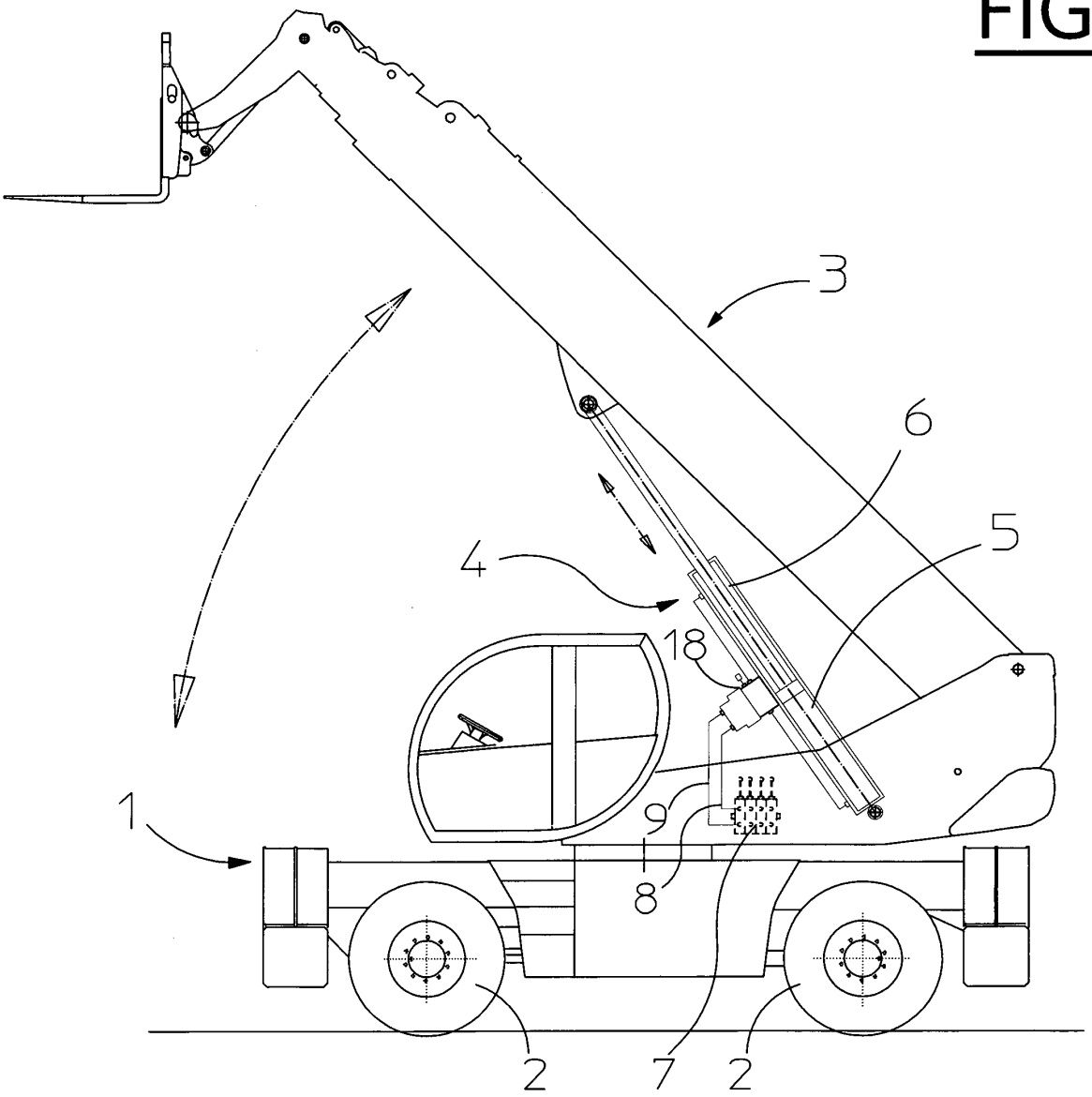
individuel (4), la vanne de régulation électronique (11) étant activée pour agir sur la vanne d'isolement (10) afin de commander et d'augmenter l'ouverture de celle-ci lorsqu'une pression d'une valeur minimum prédéterminée est atteinte côté tige (6), et d'augmenter l'ouverture de la vanne d'isolement (10) jusqu'à ce qu'une pression d'une valeur maximum prédéterminée soit atteinte côté tige (6), le moyen d'activation étant en outre configuré de telle manière que lorsque la pression côté tige (6) diminue, l'ouverture de la vanne d'isolement (10), commandée par la vanne de régulation électronique (11), est réduite, et dans le cas où le mouvement s'arrête, la vanne d'isolement (10) se ferme complètement, afin de maintenir la pression côté tige (6) dans une plage de pression préétablie.

2. Appareil selon la revendication 1, **caractérisé en ce que** la vanne de régulation électronique (11) est du type proportionnel et agit sur la vanne d'isolement (10) de manière à augmenter progressivement son ouverture à partir du moment où la pression côté tige (6) atteint la valeur minimum prédéterminée.

3. Appareil de régulation de la course d'actionneurs hydrauliques à double effet du type utilisé pour l'actionnement hydraulique d'organes de manœuvre de machines de travail, comprenant deux actionneurs hydrauliques ou vérins hydrauliques à double effet (4) ou plus, un circuit de commande hydraulique comprenant des vannes d'isolement (10), un détendeur de pression (13) et une vanne de régulation électronique (11), un distributeur hydraulique (7), un capteur de pression (12), dans lequel les deux actionneurs hydrauliques ou vérins hydrauliques à double effet (4) ou plus sont reliés en parallèle afin de coopérer ensemble en tant que couple pour ledit actionnement hydraulique et chaque actionneur hydraulique ou vérin hydraulique à double effet (4) est alimenté par le circuit de commande hydraulique relié au distributeur hydraulique (7) d'où partent des conduites d'alimentation (8) pour alimenter chaque côté inférieur (5) des deux actionneurs hydrauliques ou vérins hydrauliques à double effet (4) ou plus et d'où partent des conduites (9) pour alimenter chaque côté tige (6) des deux actionneurs hydrauliques ou vérins hydrauliques à double effet (4) ou plus, dans lequel une vanne d'isolement est placée sur chaque conduite d'alimentation (8) du côté inférieur (5), laquelle a pour but d'intercepter le flux de sortie, dans lequel les vannes d'isolement (10) sont toutes reliées à la même vanne de régulation électronique (11), l'appareil comprenant en outre un moyen d'activation configuré pour faire fonctionner la vanne de régulation électronique (11) selon le signal émis par le capteur de pression (12) selon une valeur de pression correspondante détectée côté tige (6) de l'un des deux actionneurs hydrauliques ou vérins hydrauliques (4) ou plus pour actionner les vannes d'isolement (10) afin de commander et d'augmenter l'ouverture de celles-ci lorsqu'une pression côté tige rapportée par le capteur de pression (12) ayant une valeur minimum préréglée est atteinte, et jusqu'à atteindre une pression côté tige (6) ayant une valeur maximum prédéterminée ; toutes les vannes d'isolement (10) étant actionnées hydrauliquement par la valeur de pression côté tige (6) dudit un des deux actionneurs hydrauliques ou vérins hydrauliques (4) ou plus par l'intermédiaire du détendeur de pression (13) et par l'action de modulation de la vanne de régulation électronique (11) à laquelle les vannes d'isolement (10) sont hydrauliquement reliées, afin de maintenir la pression côté tige (6) dans une plage de pression préétablie.

4. Appareil selon la revendication 3, **caractérisé en ce qu'**il comprend une vanne parachute (15) appliquée au côté inférieur (6) de chaque actionneur hydraulique ou vérin hydraulique à double effet (4), lesdites vannes parachutes (15) fonctionnant de la même manière sur les côtés inférieurs respectifs des actionneurs hydrauliques ou vérins hydrauliques à double effet et étant reliées directement entre elles hydrauliquement à l'aide d'une connexion hydraulique (16) ayant pour but d'équilibrer la pression aux côtés inférieurs des actionneurs hydrauliques ou vérins hydrauliques à double effet (4).

FIG.1



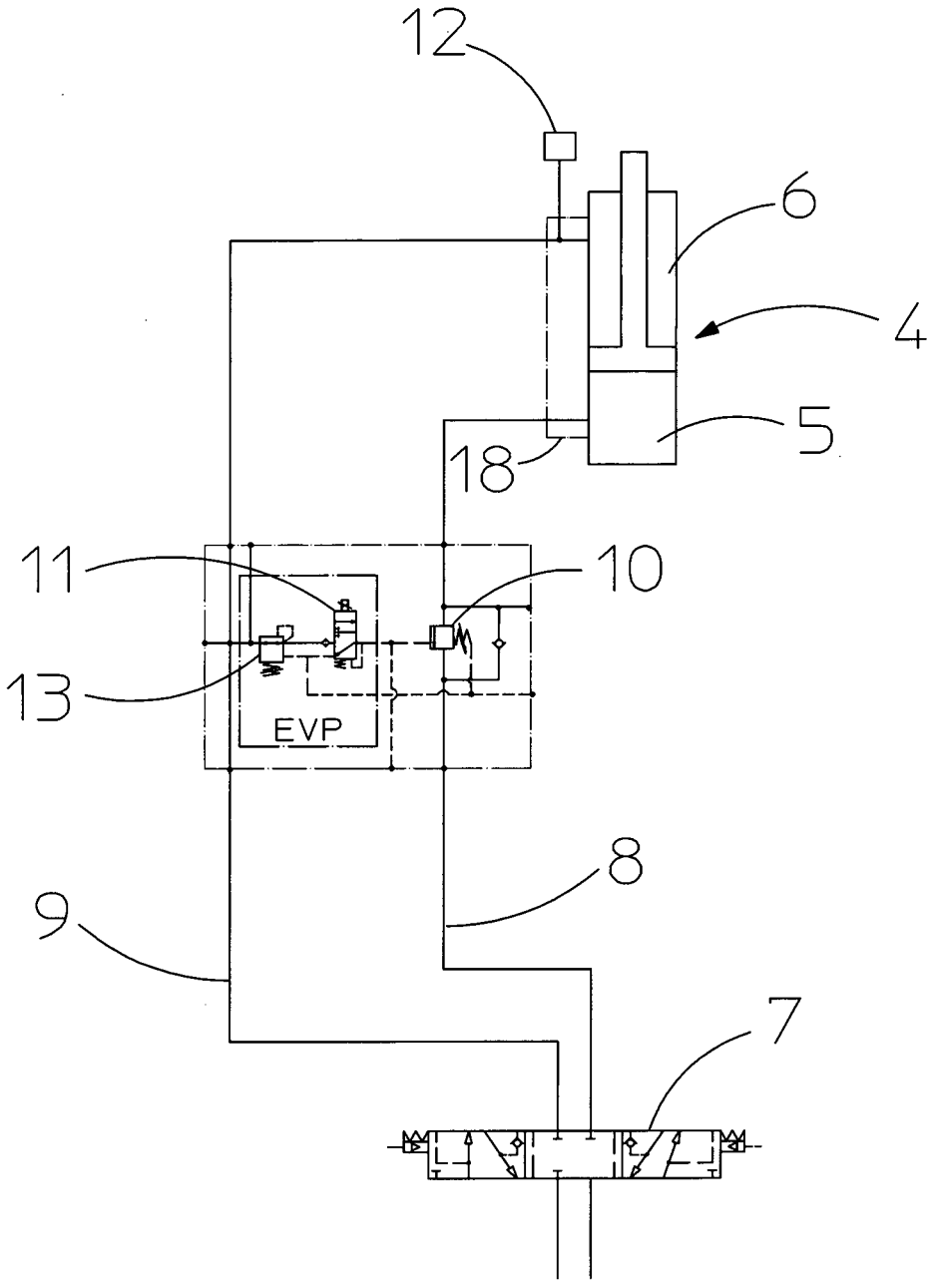
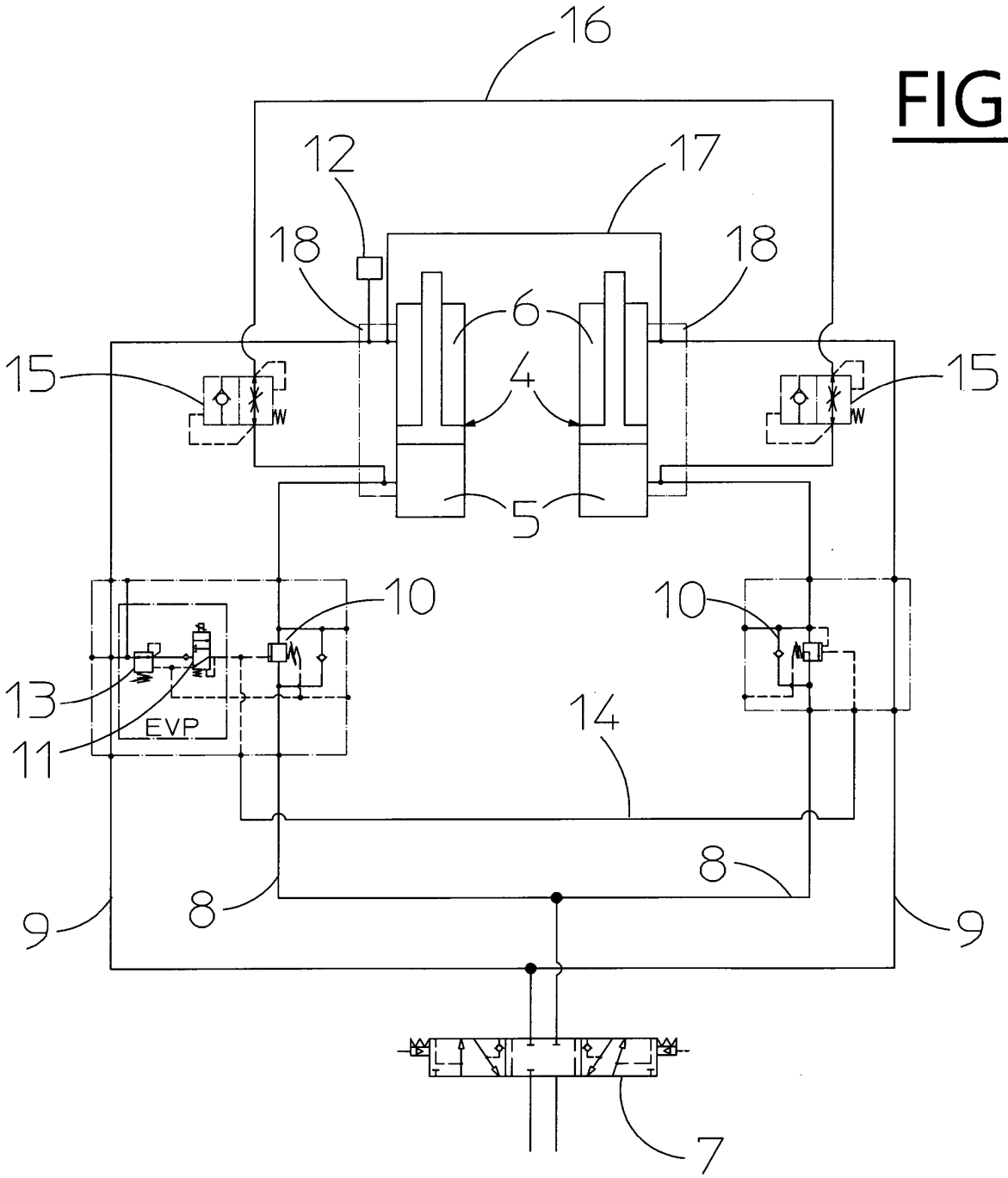


FIG.2

FIG.3



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Patent documents cited in the description

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