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(54) **DEVICE FOR CONTROLLED RE-ENTRY OF A CYLINDER**

VORRICHTUNG ZUM KONTROLLIERTEN WIEDEREINTRITT EINES ZYLINDERS

DISPOSITIF DE RENTRÉE CONTRÔLÉE D'UN CYLINDRE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a device for controlled re-entry of a cylinder, specifically for controlled re-entry of a crane cylinder.

BACKGROUND

[0002] The present invention concerns a particularly inventive system for solving a technical problem concerning the re-entry of a crane.

[0003] According to the present state of the art, during the re-entry of a crane cylinder, particularly in the case of low-velocity re-entry of a cylinder suitable for the horizontal displacement of a load, at the moment when the fluid goes toward the piston rod chamber, some instability is created in the bottom due to the current valves used in this field.

[0004] However, for crane applications where high control is required, it is necessary to adopt systems that can control movement at very low speeds, for example in the case of cranes that are suitable for handling glass for construction use. This control is so far not possible except by fluid leakage (as standard PRPF might be), which creates the inconvenience of raising system pressures, or by reducing the drive ratio, which has as a drawback an increase in consumption even when control in re-entry is not needed (e.g., when one wants to close the machine at the end of work).

[0005] In the light of the above technical problem, the purpose of the present invention is precisely to go and provide a device that makes it possible to achieve high cylinder control under all conditions and even at particularly low speeds, as required in some particular applications. DE 10 2012 220863 A1 discloses the preamble of claim 1.

SUMMARY

[0006] The present invention relates to a control system according to the features listed in claim 1.

[0007] Preferable forms of embodiment are contained in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

[0008] The present invention will be described with reference to the attached figures in which the same numbers and/or reference marks indicate the same and/or similar and/or corresponding parts of the system.

[0009] Figure 1 shows a schematic view of a device for moving a cylinder according to a particular embodiment of the present invention.

DETAILED DESCRIPTION

[0010] In the following, the present invention is described by reference to particular forms of embodiment as illustrated in the accompanying drawing plates. However, the present invention is not limited to the particular embodiments described in the following detailed description and depicted in the figures, but rather the embodiments described simply exemplify the various aspects of the present invention, the scope of which is defined by the claims.

[0011] The control device for displacing a load according to the present invention is preferably used in a power circuit for a hydraulic cylinder intended to determine the displacement of a load.

[0012] Figure 1 shows the device according to the present invention used for controlled return of a cylinder.

[0013] Displacement of the load is accomplished by means of a cylinder C shown schematically in the figure.

The C cylinder typically has two chambers C1, C2 separated by a plunger to which is associated the rod that, in various ways, is connected to the load to be moved. A first C1 chamber, typically the chamber that is located on the piston rod side of the cylinder, is intended to receive pressurized oil to determine cylinder retraction. A second chamber C2, arranged on the bottom side of cylinder C, is arranged to receive oil and determine cylinder extension.

[0014] A distributor D, usually with four ways and three positions, is arranged to determine the supply of pressurized oil to the first chamber C1 or the second chamber C2 and, at the same time, to connect the chamber that is not supplied by pressurized oil with an outlet. In the exemplary form of implementation shown schematically, the distributor D is equipped with a drawer that can assume a first position, in which the first chamber C1 is placed in communication with a source of pressurized fluid from a pump P and the second chamber C2 is placed in communication with an outlet T. This first position is schematized on the left side of the distributor D. The drawer can also assume a second position, schematized on the right side of the distributor, in which opposite connections to those in the first position are made. The drawer can also assume a central position in which the first and second chambers C1, C2 are not in communication with the pressurized fluid source P.

[0015] The control device according to the present invention includes a first conduit 20 arranged to connect the first chamber C1 of the cylinder C with the distributor D. A second conduit 30, on the other hand, is arranged to connect the second chamber C2 of the cylinder C with the distributor D.

[0016] A first valve 6, specifically a one-way valve, is arranged along the first conduit 20. The first valve 6 is configured so that it can allow fluid flow from the D distributor to the first C1 chamber and to prevent fluid flow from the first C1 chamber to the D distributor.

[0017] A second valve 1, which is specifically a balanc-

ing valve, is arranged along the second conduit 30, and is arranged to assume a closing configuration, in which it prevents fluid flow along the second conduit 30, and an opening configuration, in which it allows fluid flow along the second conduit 30, only when driven by a pilot pressure greater than a predetermined value.

[0018] For piloting the second valve 1, there is a piloting conduit 40, which connects the second valve 1 with the first conduit 20. Said pilot conduit 40 is configured to allow a pilot pressure from the first conduit 20 to reach said second valve 1 and drive it open. As shown in the embodiment shown in the figure, the pilot conduit 40 connects the second valve 1 with the first conduit 20 at a position of said first conduit 2 between the first valve 6 and the distributor D.

[0019] Parallel to said second valve 1 is a valve 12, preferably a one-way valve, which is configured to allow flow from said distributor D to said second chamber C2 and to prevent reverse flow.

[0020] A choke 7 (which is any type of orifice) is positioned along the piloting conduit 40. The device according to the present invention further includes a third conduit 50 that connects a portion of the pilot conduit 40 between the bottleneck 7 and the second valve 1 to a portion of said second conduit 30 between the second valve 1 and the second chamber C2. Along said third conduit 50 is positioned a third valve 11 (which is preferably a unidirectional valve) that is configured to allow a flow of fluid from the first conduit 20 to the second conduit 30 passing through the choke 7 and to prevent flow in the opposite direction.

[0021] The device shown in the figure further includes a bottleneck 8 positioned along the third duct 50 between the third valve 11 and the pilot duct 40. Preferably the opening of the two constrictions is the same.

[0022] In the example shown in the figure the third valve 11 and the choke are presented as two separate and distinct elements and having a precise order of placement along the third duct 50. However, it is clear that the order of the two elements along the third duct can be reversed and that these elements can be integrated together into a single valve having a choke without departing from the scope of protection defined by the claims.

[0023] The device shown in the figure further comprises a regeneration system. Such a system includes a fourth conduit 60 connecting the first conduit 20 (specifically a portion between the first valve 6 and the first chamber C1) to the second conduit 30 (specifically a portion between the second valve 1 and the second chamber C2). Along the fourth conduit 60 is positioned a valve system 2, 5 which is configured to allow a flow of fluid from the second conduit 20 and directed to the third conduit in the event that the pressure along said second conduit 30 exceeds a predetermined value and to prevent the opposite flow. Specifically, such a valve system includes a balancing valve 2 and a one-way valve 5. Unidirectional valve 5 is configured to allow a flow of fluid from the second conduit 20 and directed to the third con-

duit 30 and to prevent reverse flow. In contrast, balancing valve 2 is configured to allow a flow along the fourth duct when the pressure along said second duct 30 exceeds a predetermined value. This pressure is supplied to the balancing valve 2 via a pilot line 90 that reaches the balancing valve and comes from a portion of the second conduit 30 between the second valve 1 and the distributor D.

[0024] The balancing valve 2 also receives pressure from a portion of the first conduit 20 between the first valve 6 and the distributor D through a pilot conduit 80.

[0025] In a preferred embodiment, a regeneration system bypass system may be included. Such a bypass system preferably comprises a conduit 70 connecting a portion of the fourth conduit 60 lying between the balancing valve 2 and the one-way valve 5 to a portion of the first conduit lying between the first valve 6 and the distributor D. Along such a conduit 70 there is a valve 4 for opening and closing a flow along said conduit 70 respectively as a result of a command and preferably an uncompensated control valve 3.

[0026] With reference to Figure 1, cylinder re-entry C will now be described in such a way as to emphasize the advantages of the present invention over the state of the art.

[0027] When a re-entry of cylinder C, i.e., a displacement of the plunger to the right, is required, the control valve is moved to the left position so that pressure is supplied to the first chamber C1 through the first conduit 20. The pressure then goes to chamber C1 via the first conduit 20 and the first valve 6. However, at this point the discharge from the second chamber C2 is still closed because balancing valve 1 is still in the closed position. However, the pressure present on the first duct 20 reaches the second chamber C2 by passing through the first and second throttles 7, 8 and the one-way valve 11. Since the area of the second chamber C2 is greater than the area of the first chamber C1, and since the pressure in the two chambers is essentially the same, it would happen that the cylinder would move along the opposite direction to the one desired. However, such movement is clearly blocked by the presence of the first valve 6, which obstructs such a passage, and by the fact that the balancing valve 2 of the regeneration system is closed, due to the fact that the pilot line 90 does not supply the balancing valve 2 with any pilot pressure.

[0028] Because of this configuration, it will occur that the pressure along the first duct and then consequently along the piloting duct 40 will go to increase more and more until the pressure reaches a predetermined value at which the balancing valve 1 will go to open slowly going to slowly discharge oil to the tank T from the second chamber C2.

[0029] Because of the passage of oil through valve 1 will occur that a passage of oil through duct 50 to the second duct 30 will begin. This passage of oil will then cause a decrease in pressure along pilot port 40 at valve 1. However, this decrease in pressure is very "slight" due

to the fact that the amount of oil flowing from pilot port 40 to the second port 30 is limited by the presence of restriction 8, which allows a pressure difference to go between upstream and downstream of restriction 8. Because of this slight reduction in pressure it will be the case that an equilibrium situation will be created in which the balancing valve 1 is open with a minimum opening, which allows cylinder C to re-enter at a substantially constant and particularly reduced speed.

[0030] Otherwise, using a system known from the state of the art for cylinder re-entry, along which duct 50 is not present, it will be the case that if a particularly low re-entry velocity is required, balancing valve 1 will continue to open and close due to the fact that, even if the flow rate at the inlet of the first chamber C1 is small, the flow rate at the outlet of the second chamber C2 will still be larger and will go to decrease the pressure along the first duct 20 and consequently to cause the balancing valve 1 to close, thus generating a reiteration of the process described here and thus a "jerky" displacement.

[0031] In contrast, thanks to the present invention, it is possible to ensure a continuous opening of balancing valve 1 even in the case where minimal flow rates are provided along the first conduit 20, precisely in order to allow a particularly slow displacement of the cylinder.

[0032] In particular, due to the fact that a part of the fluid flowing along the piloting duct 40 is discharged along the second duct 30, it occurs that the piloting ratio of the balancing valve 1 decreases. In addition, due to the fact that a discharge occurs at a portion of the second duct 30 between the second chamber and the balancing valve 1 it occurs that very low speeds of cylinder displacement can be achieved because a portion of the oil flowing through the balancing valve 1 comes from the duct 40. For example, thanks to this invention, cylinder re-entry can occur at a speed of less than 2 mm/s and, for example, re-enter about 10 cm in 15 minutes.

[0033] It is emphasized that the inventive character of the present invention is concentrated in the presence of this third duct. Thanks to this duct, it is possible to make the cylinder re-enter at a constant and completely contained speed.

[0034] Such a cylinder may preferably be a cylinder configured for moving a crane whose axis is perpendicular to the force of gravity acting on the load moved by the crane.

[0035] Although the present invention has been described with reference to the forms of embodiment described above, it is clear to the person skilled in the art that various modifications, variations, and improvements of the present invention may be made in light of the teaching described above and within the scope of the appended claims, which define the scope of protection of the invention.

[0036] Finally, those areas that are believed to be known by experts in the field have not been described to avoid overshadowing the described invention unnecessarily.

[0037] Accordingly, the invention is not limited to the forms of embodiment described above, but is only limited by the scope of protection of the appended claims.

Claims

1. Device for controlling a displacement of a load, comprising:

a first conduit (20), configured so as to be able to connect a first chamber (C1) of a cylinder (C) with a distributor (D); a second conduit (30), configured so as to be able to connect a second chamber (C2) of the cylinder (C) with the distributor (D);

a first valve (6), arranged along the first conduit (20), which is configured so as to be able to allow the flow of fluid from the distributor (D) to the first chamber (C1) and to prevent the flow of fluid from the first chamber (C1) towards the distributor (D);

a second valve (1), arranged along the second conduit (30), which is arranged to assume a closed configuration, in which it prevents the flow of fluid along the second conduit (30), and an opening configuration, in which it allows the flow of fluid along the second conduit (30), only if piloted by a pilot pressure higher than a predetermined value;

a pilot conduit (40), which connects the second valve (1) with the first conduit (20) and configured so as to allow a pilot pressure to reach said second valve (1);

whereby said device further comprises a third conduit (50) which connects a portion of said pilot conduit (40) to a portion of said second conduit (30), **characterised in that** said portion of said second conduit is comprised between said second valve (1) and said second chamber (C2) and by the fact that along said third conduit (50) is positioned a third valve (11), which is configured so as to allow a flow of fluid from said first conduit (20) to said second conduit (30) and to prevent the opposite flow and a first orifice (8) positioned along said third conduit (50) between said third valve (11) and said pilot conduit (40).

2. Device according to claim 1, wherein said device further comprises a second orifice (7) positioned along said pilot conduit (40) between said second conduit (20) and the connection between said pilot conduit (40) and said third conduit (50).
3. Device according to claim 2, the opening of the first orifice (8) is equal to the opening of the second orifice (7).

4. Device according to one of the preceding claims, wherein said pilot conduit (40) connects the second valve (1) with the first conduit (20) at a position of said first conduit (20) comprised between the first valve (6) and the distributor (D). 5
5. Device according to one of the preceding claims, wherein said first valve (6) is a one-way valve and / or wherein said second valve (1) is a balancing valve, and / or wherein said third valve (11) is a one-way valve. 10
6. Device according to one of the preceding claims, wherein said device further comprises a regenerating system, said system comprises a fourth conduit (60) which connects said first conduit (20) to said second conduit (30), wherein said system comprises a valve system (2, 5) positioned along said fourth conduit (60) and configured so as to allow a flow of fluid coming from said second conduit (20) and directed to said third conduit, if the pressure along said second conduit (30) exceeds a predetermined value and to prevent the opposite flow. 15 20
7. Device according to one of the preceding claims, wherein a valve (12) is positioned parallel to said second valve (1) and is configured so as to allow flow from said distributor (D) towards said second chamber (C2) and to prevent the opposite flow. 25 30
8. Device according to one of the preceding claims, wherein said device further comprises said cylinder (C), wherein said first chamber (C1) is the chamber of the rod of said cylinder and said second chamber (C2) is the chamber of the bottom of said cylinder. 35
9. Device according to claim 8, wherein said cylinder (C) is configured so as to be able to move a load along a direction perpendicular to the force of gravity acting on said load. 40
10. Use of a device according to any one of claims 1 to 9, wherein said device is used in a crane for horizontal displacement of a load. 45
11. Use according to claim 10, wherein the load is moved at a speed of less than 2 mm / s.

Patentansprüche

1. Vorrichtung zum Steuern einer Verlagerung einer Last, umfassend:

eine erste Leitung (20), die so ausgelegt ist, dass sie eine erste Kammer (C1) eines Zylinders (C) mit einem Verteiler (D) verbinden kann; eine zweite Leitung (30), die so ausgelegt ist, dass

sie eine zweite Kammer (C2) des Zylinders (C) mit dem Verteiler (D) verbinden kann;
 ein erstes Ventil (6), das entlang der ersten Leitung (20) angeordnet ist, das so ausgelegt ist, dass es den Durchfluss von Fluid von dem Verteiler (D) zu der ersten Kammer (C1) ermöglichen kann und den Durchfluss von Fluid von der ersten Kammer (C1) hin zu dem Verteiler (D) verhindern kann;
 ein zweites Ventil (1), das entlang der zweiten Leitung (30) angeordnet ist, das so angeordnet ist, dass es eine geschlossene Auslegung, in der es den Durchfluss von Fluid entlang der zweiten Leitung (30) verhindert, und eine öffnende Auslegung, in der es den Durchfluss von Fluid entlang der zweiten Leitung (30) ermöglicht, nur annehmen kann, wenn es durch einen Ansteuerdruck angesteuert wird, der höher als ein vorbestimmter Wert ist;
 eine Ansteuerleitung (40), die das zweite Ventil (1) mit der ersten Leitung (20) verbindet und so ausgelegt ist, dass sie ermöglicht, dass ein Ansteuerdruck das zweite Ventil (1) erreicht;
 (40) mit einem Abschnitt der zweiten Leitung (30) verbindet, **dadurch gekennzeichnet, dass** der Abschnitt der zweiten Leitung zwischen dem zweiten Ventil (1) und der zweiten Kammer (C2) enthalten ist, und dadurch, dass entlang der dritten Leitung (50) ein drittes Ventil (11), das so ausgelegt ist, dass es einen Durchfluss von Fluid von der ersten Leitung (20) zu der zweiten Leitung (30) ermöglicht und den gegenläufigen Durchfluss verhindert, und ein erster Durchlass (8), der entlang der dritten Leitung (50) zwischen dem dritten Ventil (11) und der Ansteuerleitung (40) positioniert ist, positioniert ist.

2. Vorrichtung nach Anspruch 1, wobei die Vorrichtung ferner einen zweiten Durchlass (7) umfasst, der entlang der Ansteuerleitung (40) zwischen der zweiten Leitung (20) und der Verbindung zwischen der Ansteuerleitung (40) und der dritten Leitung (50) positioniert ist.
3. Vorrichtung nach Anspruch 2, wobei die Öffnung des ersten Durchlasses (8) gleich der Öffnung des zweiten Durchlasses (7) ist.
4. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Ansteuerleitung (40) das zweite Ventil (1) mit der ersten Leitung (20) an einer Position der ersten Leitung (20) verbindet, die zwischen dem ersten Ventil (6) und dem Verteiler (D) enthalten ist.
5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das erste Ventil (6) ein Einwegventil ist und/oder wobei das zweite Ventil (1) ein Aus-

gleichsventil ist, und/oder wobei das dritte Ventil (11) ein Einwegventil ist.

6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung ferner ein Regenerationssystem umfasst, wobei das System eine vierte Leitung (60) umfasst, die die erste Leitung (20) mit der zweiten Leitung (30) verbindet, wobei das System ein Ventilsystem (2, 5) umfasst, das entlang der vierten Leitung (60) positioniert und so ausgelegt ist, dass es einen Durchfluss von Fluid, das aus der zweiten Leitung (20) kommt und zu der dritten Leitung geleitet wird, ermöglicht, wenn der Druck entlang der zweiten Leitung (30) einen vorbestimmten Wert übersteigt, und einen gegenläufigen Durchfluss verhindert. 5
7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei ein Ventil (12) parallel zu dem zweiten Ventil (1) positioniert und so ausgelegt ist, dass es einen Durchfluss von dem Verteiler (D) hin zu der zweiten Kammer (C2) ermöglicht und den gegenläufigen Durchfluss verhindert. 10
8. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung ferner den Zylinder (C) umfasst, wobei die erste Kammer (C1) die Kammer der Stange des Zylinders ist und die zweite Kammer (C2) die Kammer des Bodens des Zylinders ist. 15
9. Vorrichtung nach Anspruch 8, wobei der Zylinder (C) so ausgelegt ist, dass er eine Last entlang einer Richtung senkrecht zu der auf die Last wirkenden Schwerkraft bewegen kann. 20
10. Verwendung einer Vorrichtung nach einem der Ansprüche 1 bis 9, wobei die Vorrichtung in einem Kran zur horizontalen Verlagerung einer Last verwendet wird. 25
11. Verwendung nach Anspruch 10, wobei die Last mit einer Geschwindigkeit unter 2 mm/s bewegt wird. 30

Revendications 35

1. Dispositif de commande de déplacement d'une charge, comprenant : 40

un premier conduit (20), conçu pour être propre à raccorder une première chambre (C1) d'un vérin (C) avec un distributeur (D) ; un deuxième conduit (30), conçu pour être propre à raccorder une seconde chambre (C2) du vérin (C) avec le distributeur (D) ; 50

une première vanne (6), placée le long du premier conduit (20), qui est conçue pour être propre à permettre l'écoulement de fluide depuis le

distributeur (D) vers la première chambre (C1) et à empêcher l'écoulement de fluide depuis la première chambre (C1) vers le distributeur (D) ; une deuxième vanne (1), placée le long du deuxième conduit (30), qui est conçue pour adopter une configuration fermée, dans laquelle elle empêche l'écoulement de fluide le long du deuxième conduit (30), et une configuration ouverte, dans laquelle elle permet l'écoulement de fluide le long du deuxième conduit (30), uniquement si elle est pilotée par une pression de pilotage supérieure à une valeur prédéterminée ; un conduit de pilotage (40), qui raccorde la deuxième vanne (1) avec le premier conduit (20) et conçu pour permettre à une pression de pilotage d'atteindre ladite deuxième vanne (1) ; de pilotage (40) à une partie dudit deuxième conduit (30), **caractérisé en ce que** ladite partie dudit deuxième conduit est située entre ladite deuxième vanne (1) et ladite seconde chambre (C2) et par le fait qu'une troisième vanne (11) est placée le long dudit troisième conduit (50), celle-ci étant conçue pour permettre un écoulement de fluide dudit premier conduit (20) audit deuxième conduit (30) et pour empêcher l'écoulement inverse, et qu'un premier orifice (8) est placé le long dudit troisième conduit (50) entre ladite troisième vanne (11) et ledit conduit de pilotage (40). 55

2. Dispositif selon la revendication 1, ledit dispositif comprenant, en outre, un second orifice (7) placé le long dudit conduit de pilotage (40) entre ledit deuxième conduit (20) et le raccord entre ledit conduit de pilotage (40) et ledit troisième conduit (50). 60
3. Dispositif selon la revendication 2, dans lequel l'ouverture du premier orifice (8) est égale à l'ouverture du second orifice (7). 65
4. Dispositif selon l'une des revendications précédentes, dans lequel ledit conduit de pilotage (40) raccorde la deuxième vanne (1) avec le premier conduit (20) à un emplacement dudit premier conduit (20) situé entre la première vanne (6) et le distributeur (D). 70
5. Dispositif selon l'une des revendications précédentes, dans lequel ladite première vanne (6) est un clapet de non-retour et/ou dans lequel ladite deuxième vanne (1) est une vanne d'équilibrage, et/ou dans lequel ladite troisième vanne (11) est un clapet de non-retour. 75
6. Dispositif selon l'une des revendications précédentes, ledit dispositif comprenant, en outre, un système de régénération, ledit système comprenant un quatrième conduit (60) qui raccorde ledit premier conduit 80

(20) audit deuxième conduit (30), ledit système comprenant un système de vannes (2, 5) placé le long dudit quatrième conduit (60) et conçu pour permettre un écoulement de fluide depuis ledit deuxième conduit (20) vers ledit troisième conduit, si la pression le long dudit deuxième conduit (30) dépasse une valeur prédéterminée et pour empêcher l'écoulement inverse. 5

7. Dispositif selon l'une des revendications précédentes, dans lequel une vanne (12) est placée parallèlement à ladite deuxième vanne (1) et est conçue pour permettre un écoulement depuis ledit distributeur (D) vers ladite deuxième chambre (C2) et pour empêcher l'écoulement inverse. 10
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8. Dispositif selon l'une des revendications précédentes, ledit dispositif comprenant, en outre, ledit vérin (C), dans lequel ladite première chambre (C1) est la chambre de la tige dudit vérin et ladite seconde chambre (C2) est la chambre du fond dudit vérin. 20
9. Dispositif selon la revendication 8, dans lequel ledit vérin (C) est conçu pour être propre à déplacer une charge le long d'une direction perpendiculaire à la force gravitationnelle agissant sur ladite charge. 25
10. Utilisation d'un dispositif selon l'une quelconque des revendications 1 à 9, dans laquelle ledit dispositif est utilisé dans une grue pour le déplacement horizontal d'une charge. 30
11. Utilisation selon la revendication 10, dans laquelle la charge est déplacée à une vitesse inférieure à 2 mm/s. 35

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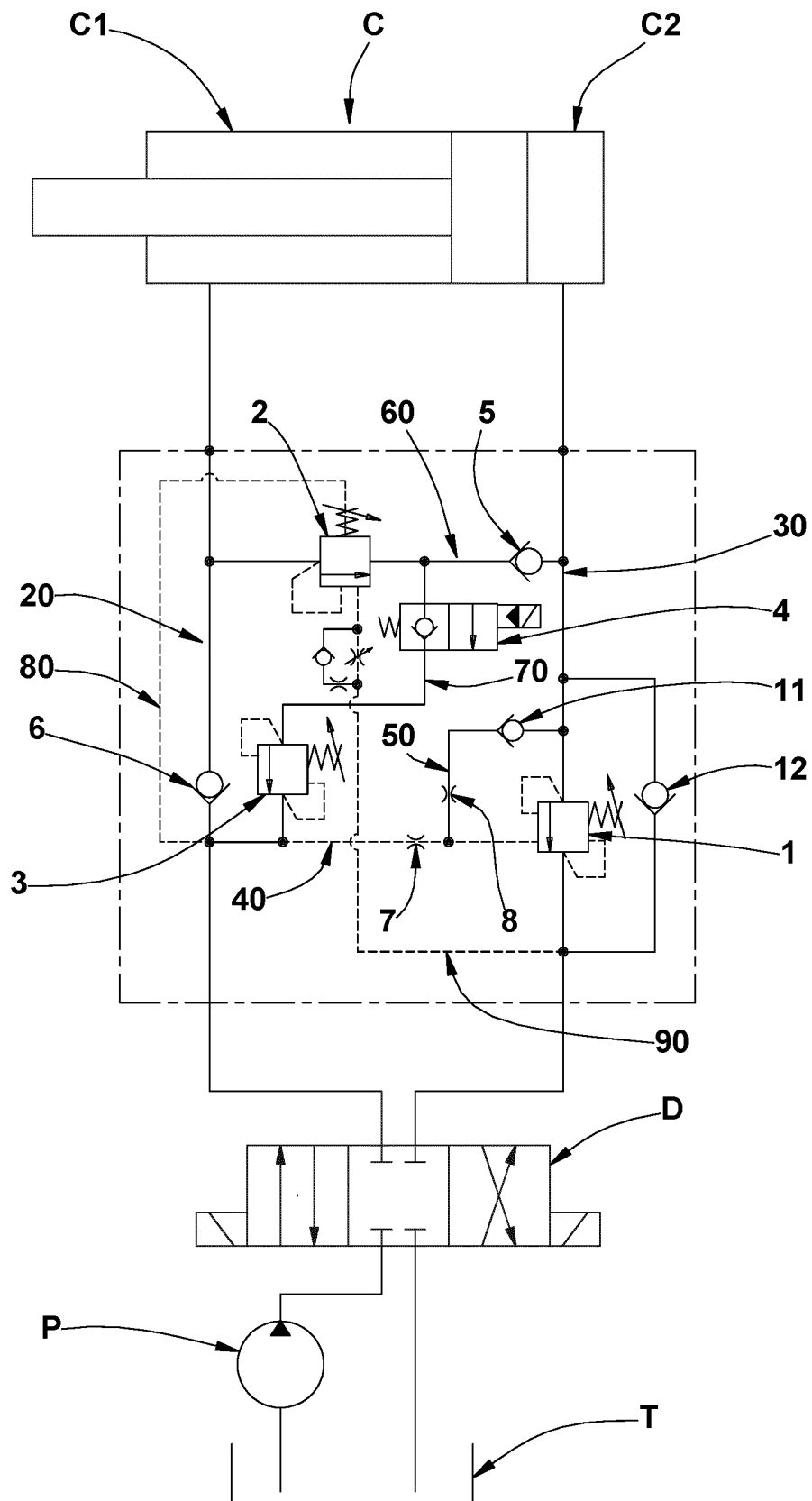


Fig.1

REFERENCES CITED IN THE DESCRIPTION

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