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(54) ELECTROHYDRAULIC LIFTING DEVICE FOR MOTOR VEHICLES

ELEKTROHYDRAULISCHE HEBEVORRICHTUNG FÜR MOTORFAHRZEUGE

DISPOSITIF DE LEVAGE ELECTRO-HYDRAULIQUE POUR VEHICULES A MOTEUR

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EP-A- 0 566 203 **DE-A- 3 439 292**
FR-A- 1 575 128 **US-A- 5 072 649**

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EP 0 724 542 B1

Description

TECHNICAL FIELD

The present invention relates to the technical field concerned with devices used to lift motor vehicles.

BACKGROUND ART

Presently, it is known to use electrohydraulic devices which allow to lift motor vehicles up to a height that is suitable to make their lower part accessible.

Particularly there are known devices, so called scissor lifts, that are adapted to be fixed to the floor or to be set in a properly prepared seat.

As it is shown, for example, in Fig. 1a, 1b and 2, the above mentioned devices basically include a pair of support platforms 1 that are horizontal and parallel to one another, these support platforms being long enough to hold the vehicle to be lifted.

The support platforms 1 are mounted on pairs of tie rods 2 which are hinged to one another at their midpoint, like a scissor, while respective cylinders 3 are connected to them.

If the lifting device is fixed to the floor, there will be provided sloped tracks 4 aimed at permitting a vehicle to run over the support platforms 1.

To give safety, the support platforms are also equipped with stops 5, 6 at their ends. Such a device being known from DE-A-3499292.

In the above mentioned devices, the problem arises that concerns the synchronisation of the support platforms movements, in any operation conditions.

In fact, the support platforms are not bound to each other, and they are mounted independently from each other, so that the space defined between them is left free and accessible.

For this purpose the support platforms are moved by means of a hydraulic control unit that has the task of controlling the supply and discharge of the hydraulic pressure media to and from the respective cylinders, as it is shown in the diagram in Figure 3.

For sake of clarity, in this diagram P1 and P2 respectively indicate the main cylinder and the secondary cylinder of the support platforms, while the support platforms are indicated by 1a, the former, and 1b the latter.

The main cylinder P1 is supplied, via the conduit 7, with fluid coming from the pump 8 that is operated by a motor 9.

A branch 10 starts from the conduit 7, downstream of the pump 8, and serves as a return way for the hydraulic media to the reservoir 11. The branch 10 includes the solenoid valve 12, activated during the lowering stage, and the flow rate adjustment valve 13.

The main cylinder P1, in its turn, feeds the secondary cylinder P2 via the conduit 14. Both the main cylinder and the secondary cylinder are equipped with

respective cutoff valves 15.

Feeding the main cylinder P1 causes a certain volume of hydraulic media to flow from this cylinder to the secondary cylinder P2 that is in this way also fed.

It must be noted that the secondary cylinder P2 has a cross section reduced with respect to the main cylinder P1, that is, the cross section of the inner chamber of the secondary cylinder P2 has the same area as the working cross section area of the inner chamber of the main cylinder P1, i.e. the area calculated taking into account the presence of the stem therein.

In this way the volume of fluid that is displaced to the secondary cylinder P2 theoretically is equal to the volume of fluid delivered to the main cylinder P1, so that like displacements occur for both the support platforms.

The volume of fluid that is first displaced from the main cylinder P1 to the secondary cylinder P2 returns than back to the main cylinder P1 in the discharge stage, that is when the support platforms are lowered.

In this stage the fluid that is contained in the main cylinder is instead discharged into the reservoir 11, because of the opening of a solenoid valve 12.

Generally, a synchronical motion is not always assured for the two support platforms, particularly because of small leakages of the fluid through the seals of the plungers of the cylinders. These leakages may cause a variation of the volume of fluid that is displaced, and consequently the synchronical motion of the platforms can be lost.

If the volume of the fluid supplied to the cylinder P2 is increased, then e.g. in the discharge stage the plunger of this cylinder will not return to the correct position, and this would provoke a nonalignment of the support platform when they are at the floor level.

If the volume of the fluid supplied to the cylinder P2 decreases, then the support platforms remain at different height, that is the first support platform 1a is at an higher level than the second support platform 1b.

Furthermore, usually at the starting the second cylinder P2 is delayed with respect to the first cylinder P1, and this is due to the compressibility of the hydraulic fluid. Because of the compressibility of the hydraulic fluid, an initial motion of the plunger of the cylinder P1 does not determine a corresponding fluid displacement but only a fluid compression, and therefore the cylinder P2 is not operated.

This delay effect is increased at the starting because this condition is the one in which the fluid is at the maximum pressure, considering a certain constant load, and because the cylinders are in an almost horizontal position, and therefore the ratio between the vertical motion of the support platforms and the motion of the plungers is the highest.

According to another known solution, the two cylinders P1 and P2 are fed independent from one another (for example, by means of a flow distributor valve) and synchronism of the two support platforms 1a, 1b is obtained by means of a mechanical linkage set between

the tie rods 2 (see Fig. 1a).

This expedient does not result in an optimal effect because of the considerable mechanical stress (mainly torsional stress) that affect the parts of this mechanical linkage.

A further solution for synchronising the support platforms is known from German patent DE 3439292. Said document discloses a synchronisation device comprising two valves, the first of whose is located between the recycling conduit, connecting the main cylinder to the secondary cylinder, and a discharge reservoir; the second valve is located between the same conduit and the main hydraulic conduit.

The first valve is normally closed, and it is opened by a first support platform, moved by the secondary cylinder, when it reaches its upper end position.

In a similar way, the second valve is normally closed, and it is opened by a second support platform, moved by the main cylinder, when it reaches its upper end position.

Thus, if the platforms are nonaligned, in order to get them into alignment, they must be taken to their higher position, by connecting the recycling conduit either to a discharge, if the first platform is higher than the second one, or to the main circuit, if said first platform is lower.

That mode of operation leads to some undesirable situations in operating the lifting device.

In fact, the load supported by the platforms must be taken to a high position, while being highly unbalanced. This can be dangerous for both the load and the operators staying close to the lifting device.

DISCLOSURE OF THE INVENTION

The object of the present invention is to contrive an electrohydraulic lifting device in which the motion of the two support platforms is kept synchronous and in which the support platforms are perfectly in alignment with each other, when they are at the floor level at the end of every working cycle. This is obtained by providing for a compensation to the compressing action of the hydraulic media at the starting.

The above mentioned object is achieved by an electrohydraulic lifting device for motor vehicles includes a pair of support platforms, respectively a first support platform and a second support platform, which are horizontal and parallel to each other, and mounted on respective tie rods respectively actuated by a main cylinder and by a secondary cylinder.

The secondary cylinder is fed by the main cylinder, under the control of a hydraulic control unit. The hydraulic control unit is equipped with a synchronisation device including a synchronisation valve (18) aimed at connecting a hydraulic media conduit, delivering hydraulic fluid to the said main cylinder, with a recycling conduit leading a suitable volume of hydraulic fluid from the same main cylinder to the secondary cylinder, so as to compensate the inadequacy of the delivery of fluid to

the secondary cylinder, or alternatively aimed at deviating an exceeding part of the recycled fluid to a discharge, respectively at the starting and when the support platforms are getting into alignment at the floor level.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristic features of the invention are set out in the following description, with particular reference to the accompanying drawings, in which:

- Figures 1a and 1b show schematic side views of a lifting device, in a raised position and in a lowered position respectively;
- Figure 2 shows a plan view of the lifting device;
- Figure 3 shows a schematic diagram of the operation facility set up for a conventional lifting device;
- Figure 4 shows a schematic diagram of the electrohydraulic operation facility set up for the lifting device made in accordance with the present invention, as it looks at the starting;
- Figures 5, 6 and 7 show the same diagram of the electrohydraulic operation facility at an intermediate raising stage, at an intermediate lowering stage and when they are getting in mutual alignment on the floor, respectively.

BEST MODE OF CARRYING OUT THE INVENTION

Having reference to the above mentioned figures 4,5,6 and 7, the electrohydraulic control unit 16 of the subject lifting device, includes a synchronisation device 17 that is aimed at keeping the synchronism of the motion of the two support platforms 1a and 1b.

This synchronisation device 17 is equipped with a mechanically operated valve 18 that is mounted on an auxiliary conduit 19 through which the hydraulic media is delivered to the secondary cylinder P2. The auxiliary conduit 19 starts from the conduit 20 used to feed the main cylinder P1.

The normally closed two-way synchronisation valve 18 is controlled by the support platform 1b, by means of a push rod 21.

The part of the conduit 19 downstream of the synchronisation valve 18, is connected to the recycling conduit 22 that leads the hydraulic flow from the main cylinder P1 to the secondary cylinder P2. Along the conduit 22 there is set a pressure switch 23 and a normally closed cock 24 connected to the supply conduit 20.

Operation of the device will be described in the following, beginning from the starting stage as it is shown in Figure 4.

In this stage the synchronisation valve 18 is open because of the thrust made by the support platform 1b on the push rod 21.

Therefore the hydraulic media delivered by the pump 8 to the main cylinder P1 via the conduit 20, is

partially deviated to the secondary cylinder P2 via the auxiliary conduit 19.

In this way the delay in displacing the fluid from the main cylinder P1 to the secondary cylinder P2 through the recycling conduit 22, due to the compression of the fluid, is compensated by the volume of fluid directly fed to the cylinder P2, and the synchronous motion of the support platform 1a and 1b is therefore assured.

The raising motion of the support platform 1b causes the synchronisation valve 18 to close, so that afterwards, during the raising motion of the support platforms, the conduits 20 and 22 are no longer connected to each other. Then, the secondary cylinder P2 is supplied only with the fluid displaced from the main cylinder P1 through the recycling conduit 22 (See Figure 5).

In a similar way, when the support platforms are lowering, since the synchronisation valve 18 is closed, the fluid present into the secondary cylinder P2 flows back to the main cylinder P1 only through the recycling conduit 22 (see Figure 6).

The fluid used to actuate the main cylinder P1, is instead sent to the reservoir 11 through the conduit 10 after that the solenoid valve 12 has been properly opened.

When the support platforms reach the floor level, the support platform 1b provokes again opening of the synchronisation valve 18, so that the fluid from the secondary cylinder P2 also flows through the auxiliary conduit 19 (see Figure 7).

In this way, hydraulic fluid in excess, due to possible leakages, is directly discharged into the reservoir 11. On the contrary, a possible inadequacy of the fluid present in the main cylinder P1 is compensated by deviating a part of the fluid being discharged from the same main cylinder P1, to the recycling conduit 22.

The support platform 1b keeps the synchronisation valve 18 open through a rising stroke of about 10 mms.

In the lifting device just described, the problem of keeping the support platforms in alignment when at floor level at the end of every working cycle, is therefore solved. Also the problem of maintaining the synchronism of the two support platforms at the starting stage, due to the fluid compressibility, is solved.

It is understood that what has been described above is only illustrative, therefore possible constructive variants are within the protection of the present invention as described hereinabove and claimed in the following.

Claims

1. Electrohydraulic lifting device for motor vehicles, including a pair of support platforms (1a,1b), respectively a first support platform and a second support platform, which are horizontal and parallel to each other, these support platforms (1a,1b) being mounted on respective tie rods (2) and respectively set in motion by a main cylinder (P1)

and a secondary cylinder (P2) that is fed by the main cylinder (P1), under the control of an electrohydraulic control unit (16), which is equipped with a synchronisation device (17) placed along an auxiliary conduit (19), connecting a hydraulic media conduit (20) delivering hydraulic fluid to the said main cylinder (P1), with a recycling conduit (22) leading a suitable volume of hydraulic fluid from the same main cylinder (P1) to the said secondary cylinder (P2), the said lifting device being characterised in that said synchronisation device (17) includes a single synchronisation valve (18), aimed at opening the said connection between the hydraulic media conduit (20) and the recycling conduit (22) at the starting of the support platforms (1a,1b) from the floor level, or alternatively aimed at deviating an exceeding part of the recycled fluid to a discharge, when said support platforms (1a,1b) are reaching the floor level, to get them into alignment.

2. Device as claimed in claim 1, characterised in that the said synchronisation valve (18) is mechanically operated, either to get open or closed, as a consequence of the lowering or raising of the said support platform (1b) respectively.
3. Device as claimed in claim 1, characterised in that, when said support platforms (1a,1b) are starting from the floor level, some more hydraulic fluid is allowed to be pumped into said recycling conduit (22).
4. Device as claimed in claim 1, characterised in that during normal operation, when the said support platforms (1a,1b) are raising or lowering, the said synchronisation valve (18) is normally closed, so that the said delivery conduit and the said recycling conduit (22) are not connected with each other, and the said secondary cylinder (P2) is fed only with the hydraulic fluid coming from the said main cylinder (P1) through the said recycling conduit (22).
5. Device as claimed in claim 1, characterised in that when the support platforms are getting into alignment at the floor level, said synchronisation valve (18) is opened to deviate part of the fluid being discharged from the same main cylinder (P1) to the recycling conduit (22) for compensation of inadequacy of the recycling fluid present in said main cylinder (P1).

Patentansprüche

1. Elektro-hydraulische Hubeinrichtung für Kraftfahrzeuge mit zwei Plattformen (1a, 1b), nämlich einer ersten und einer zweiten Plattform, die waagrecht und parallel zueinander liegen, und die jeweils an Stützstangen (2) befestigt sind, die jeweils von ei

nem Hauptzylinder (P1) und einem Sekundärzylinder (P2) betätigt werden, der mit Hilfe einer elektrohydraulischen Steuerung (16) vom Hauptzylinder (P1) her beaufschlagt wird, wobei die Steuerung mit einer Synchronisiereinrichtung (17) versehen ist, die in einer Hilfsleitung (19) liegt, welche eine hydraulische Strömungsmittleitung (20) zum Zuführen von Strömungsmittel zum Hauptzylinder (P1) mit einer Überströmleitung (22) verbindet, in der eine passende Strömungsmittelmenge aus dem Hauptzylinder (P1) zum Sekundärzylinder (P2) strömt, wobei die Hubeinrichtung dadurch gekennzeichnet ist, daß die Synchronisiereinrichtung (17) ein einzelnes Synchronisierventil (18) aufweist, daß beim Abheben der Plattformen (1a, 1b) vom Boden die Verbindung zwischen der Strömungsmittleitung (20) und der Überströmleitung (22) öffnet, bzw. alternativ eine Überschußmenge des Strömungsmittels aus der Überstromleitung in einen Abfluß ableitet, sobald die Plattformen (1a, 1b) den Boden erreichen, um diese aufeinander auszurichten.

2. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Synchronisierventil (18) mechanisch in die Öffnungs- oder Schließlage betätigt wird, abhängig vom Absenken oder Hochfahren der einen Plattform (1b).

3. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß beim Abheben der Plattformen (1a, 1b) vom Boden zusätzliches hydraulisches Strömungsmittel in die Überströmleitung (22) gepumpt wird.

4. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß im Normalbetrieb das Synchronisierventil (18) normalerweise geschlossen ist, wenn die Plattformen (1a, 1b) hochfahren oder abwärts fahren, so daß die hydraulische Zuleitung und die Überströmleitung (22) nicht miteinander verbunden sind und daß der Sekundärzylinder (P2) nur mit dem hydraulischen Strömungsmittel beaufschlagt wird, das aus dem Hauptzylinder (P1) durch die Überströmleitung (22) strömt.

5. Einrichtung nach Anspruch 1, dadurch gekennzeichnet, daß beim Annähern der Plattformen an den Boden eine nicht ausreichende Überström-Strömungsmittelmenge im Hauptzylinder (P1) dadurch kompensiert wird daß ein Teil des aus diesem Hauptzylinder (P1) ausströmenden Strömungsmittels in die Überströmleitung (22) geführt wird.

Revendications

1. Dispositif de levage électro-hydraulique pour des

véhicules à moteur, incluant une paire de plate-formes de support (1a, 1b), respectivement une première plate-forme de support et une seconde plate-forme de support, qui sont horizontales et parallèles l'une à l'autre, ces plate-formes de support (1a, 1b) étant montées sur des tiges de liaison respectives (2) et respectivement mis en mouvement par un piston principal (P1) et un piston secondaire (P2) qui est alimenté par le piston principal (P1), sous la commande d'une unité de commande électro-hydraulique (16) qui est équipée avec un dispositif de synchronisation (17) placé le long d'un conduit auxiliaire (19), reliant un conduit de milieu hydraulique (20) délivrant du fluide hydraulique audit piston principal (P1), avec un conduit de recyclage (22) conduisant un volume adapté de fluide hydraulique depuis le même piston principal (P1) vers ledit piston secondaire (P2), ledit dispositif de levage étant caractérisé en ce que ledit dispositif de synchronisation (17) inclut une vanne de synchronisation unique (18), assurant en ouverture ladite connexion entre le conduit de milieu hydraulique (20) et le conduit de recyclage (22) au départ des plate-formes de support (1a, 1b) du niveau du sol ou alternativement assurant en déviation l'évacuation d'une partie excédentaire du fluide recyclé vers un échappement, lorsque lesdites plate-formes de support (1a, 1b) ont atteint le niveau du sol pour amener celles-ci en alignement.

2. Dispositif selon la revendication 1, caractérisé en ce que ladite vanne (18) de synchronisation est commandée de manière mécanique soit pour être ouverte soit pour être fermée, en conséquence de l'abaissement ou de l'élévation de ladite plate-forme de support (1b) respectivement.

3. Dispositif selon la revendication 1, caractérisé en ce que, lorsque lesdites plate-formes de support (1a, 1b) sont en train de démarrer du niveau du sol, plus de fluide hydraulique est autorisé à être pompé dans ledit conduit de recyclage (22).

4. Dispositif selon la revendication 1, caractérisé en ce que, en fonctionnement normal, lorsque lesdites plate-formes de support (1a, 1b) sont en train de monter ou descendre, ladite vanne de synchronisation (18) est normalement fermée, de sorte que ledit conduit de délivrance et ledit conduit de recyclage (22) ne sont pas reliés l'un à l'autre et ledit second piston (P2) est alimenté seulement avec le fluide hydraulique venant dudit piston principal (P1) à travers ledit conduit de recyclage (22).

5. Dispositif selon la revendication 1, caractérisé en ce que, lorsque les plate-formes de support viennent en alignement au niveau du sol, l'inadéquation du fluide de recyclage présent dans ledit piston

principal (P1) est compensée en dérivant une partie du fluide étant déchargé depuis le même piston principal (P1) vers le conduit de recyclage (22).

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FIG. 1a

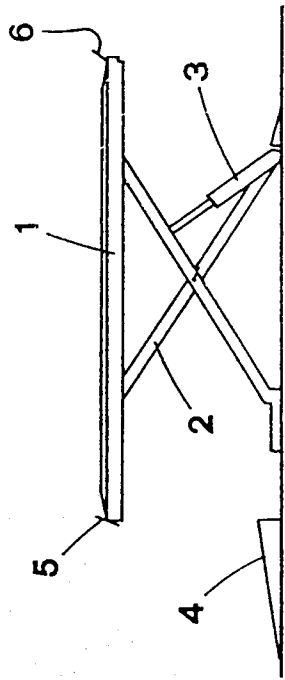


FIG. 1b

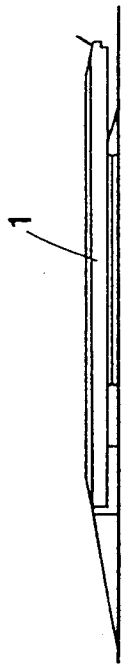
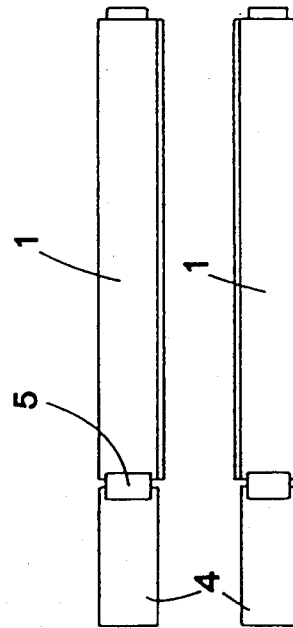


FIG. 2



PRIOR ART

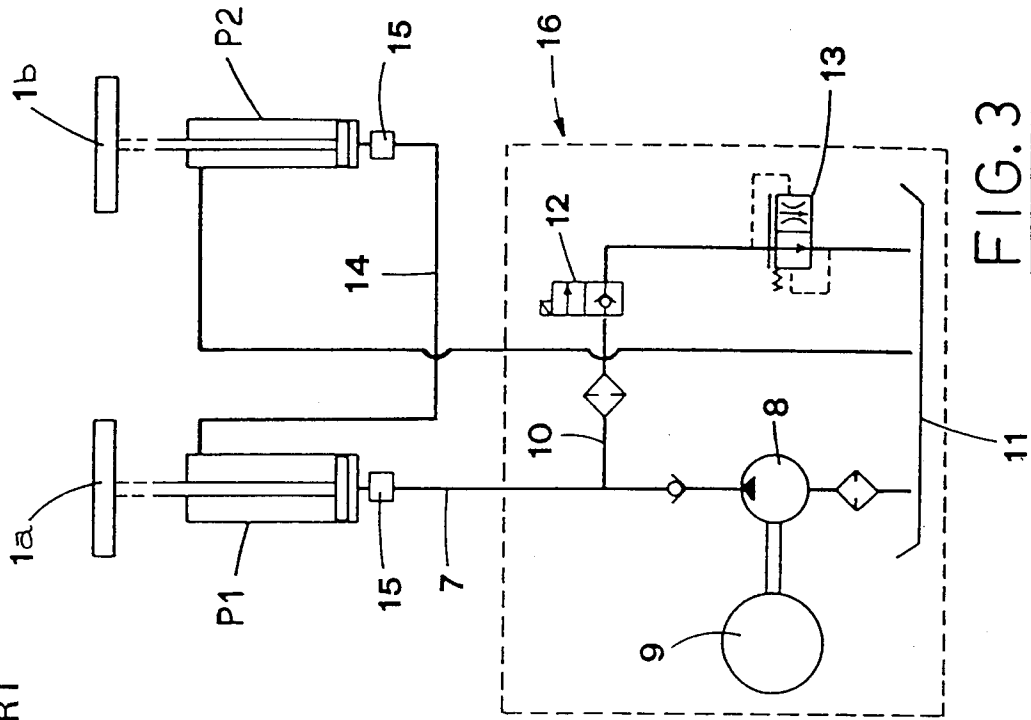


FIG. 3

