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(54) **Auxiliary command assembly for commanding the opening/closing of the head valves of a combustion engine, in particular for a decompression engine brake operation**

Zusätzliche Befehlsanordnung zur Steuerung der Öffnung/Schließung der Kopfventile in einem Verbrennungsmotor, insbesondere für den Betrieb einer Dekompressions-Motorbremse

Ensemble de commande auxiliaire destinée à commander l'ouverture/la fermeture des soupapes principales d'un moteur à combustion interne, en particulier pour une opération de freinage d'un moteur de décompression

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(56) References cited:
WO-A2-94/28288
DE-A1-102011 005 575
US-A- 4 615 307
US-A1- 2003 209 215
US-A1- 2006 070 593

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Description

Field of the invention

[0001] The present invention relates to a auxiliary command assembly for commanding the opening/closing of the head valves of a combustion engine, in particular for a decompression engine brake operation, in the field of industrial and commercial vehicles.

[0002] An example of assembly for commanding the opening/closing of the head valves of a combustion engine is given in US4615307, whose features are in the preamble of claim 1.

Description of the prior art

[0003] There are substantially two arrangements to command the movement of the valves, through the finger follower or the rocker arm.

[0004] In the first case a cam pushes on an intermediate part of the finger follower, while the two opposite ends of the finger follower are one in contact with a head valve, and the other in contact with a reference point or adjustable point through said HLA means.

[0005] In the second case the rocker arm has a referenced fulcrum at an intermediate part of the arm itself, while its two opposite ends are one in contact with a head valve, and the other in contact with a cam directly or through a pushing rod. Also in this case the fulcrum can be provided with HLA means.

[0006] In any case there is a reference point in contact with the finger follower/rocker arm that can be eventually provided with lash adjusting means.

[0007] The lash adjusting means are often implemented for slightly varying of the lash of the valves according to various engine working conditions. Usually, such lash adjusting means are hydraulically type and called HLA, namely hydraulic lash adjustment.

[0008] Decompression engine brake systems are state of the art.

[0009] A known system includes the axial shifting of the cam shaft enabling a different profile according to the activation of the engine braking condition. This solution implies several difficulties in order to avoid any interference between valve and pistons during the cam shifting. Costs and space requirements are high.

[0010] A further known approach is to operate with two valve lashes. The larger one is activated for fired operation and the small one for braking mode

[0011] In addition, when the valve train implements hydraulic elemet for adjusting the valve lash, the implementation of decompression engine brake systems is very difficult.

[0012] Indeed the HLA, if present, have to be always loaded axially, namely in contact with its one end of finger follower of with the fulcrum of the rocker arm, in order to prevent the HLA from increasing its natural extension. When the HLA is compressed again, it needs some time to reduce its extension, this forcing the valve opening by causing the interference among valves and pistons.

Summary of the invention

[0013] It is the main object of the present invention to provide at least an alternative, with respect to the prior art, auxiliary command assembly for commanding the opening/closing of the head valves of a combustion engine, for example in order to implement the decompression engine braking strategy or an internal EGR or other strategies.

[0014] The present invention can be advantageously implemented in those combustion engines provided with rocket arm or with finger follower, without changing the standard exhaust cam profile, which remain constantly in contact with a respective roller of the finger follower or of the rocker arm.

[0015] Advantageously, the cam shaft is not shifted, therefore, there is no risk in term of shifting synchronization.

[0016] The main principle of the invention is to implement the activation of an auxiliary cam profile by moving accordingly the reference point defining a fulcrum of the oscillating arm - rocker arm or finger follower - present in any configuration even in case said reference point is provided with HLA.

[0017] This permits to at least partially overrun of the commanding action of a normal cam driving said oscillating arm, namely the rocker arm or finger follower.

[0018] Advantageously, in case the HLA is implemented, it remain constantly loaded without preventing its unwanted extension increasing.

[0019] In the latter case, the reference point coincides with the base of the HLA, which is shifted upwardly/downwardly by an actuator commanded by the auxiliary cam arranged, preferably, on the same cam shaft of the normal cam or it can be driven separately by the engine crankshaft.

[0020] Therefore, said auxiliary cam commands said actuator assembly, which shift said reference point.

[0021] According to a preferred embodiment of the invention, said means for moving the reference point comprise a hydraulic circuit which is pressurized/discharged according respectively with the activation/deactivation of an auxiliary strategy, namely a decompression engine braking strategy or an internal EGR strategy. Thus the auxiliary cam profile pushes/releases a master piston in hydraulic connection with a hydraulic actuator suitable to shift/translate the reference point of the finger follower/rocker arm.

[0022] According to another preferred embodiment of the invention, said means for moving the reference point comprise a leverage assembly suitable to mechanical (in the sense not hydraulic) shift said reference point.

[0023] Advantageously, in case the head of the engine is provided with HLA, the actuator move/translate the support or base of the HLA, the latter remaining always

compressed between the finger follower/rocker arm and the actuator.

[0024] An object of the present invention is an auxiliary command assembly for commanding the opening/closing of the head valves of a combustion engine.

[0025] Another object of the present invention is a combustion engine comprising the above mentioned auxiliary valves command assembly.

[0026] A further object of the present invention is a vehicle provided of said combustion engine and a method corresponding to said structural auxiliary assembly.

[0027] The attached claims describe preferred embodiment of the present invention, forming an integral part of the present description.

Brief description of the drawings

[0028] The invention will become fully clear from the following detailed description, given by way of a mere exemplifying and non limiting example, to be read with reference to the attached drawing figures, wherein:

- Fig. 1 shows a side view of a finger follower example of implementation of a mechanical valve actuation system including the auxiliary valves command assembly object of the present invention;
- Fig. 2 shows a side view of another example (rocker) of implementation of the auxiliary valve actuation system object of the present invention;
- Figs. 3 and 4 show views of the example of figure 1 including the auxiliary valves command assembly in order to shift the reference point of the oscillating arm commanding the valves according to an additional hump suitable to implement a decompressing braking or an internal EGR strategy or other strategies;
- Figs 5 and 6 show the same side view of figure 3 of first and second variations of the embodiment of figure 3;
- Figs 7 and 8 show two possible embodiments of a detail of the previous figure 3 - 6;
- Fig. 9 show a perspective view of the subject of figure 6;
- Fig. 10 shows a side view of another embodiment of the invention.

[0029] The same reference numerals and letters in the figures designate the same or functionally equivalent parts.

Detailed description of the preferred embodiments

[0030] Figure 1 and 2 show two different assemblies for commanding the engine head valves V.

[0031] On figure 1 is shown a so called finger follower FF configuration with an oscillating arm having two opposite ends 1 and 2.

[0032] According to the present description, the attributes "first", "second" are used only for differentiating the component names for clarity reasons, thus they should not be intended in a limitative manner: a second does not implies a first. The first end is supported by a reference point RP, that can be provided of a HLA, during a normal engine operation condition, for example when the engine is fired.

[0033] The second end 2 is in contact with the stem of the engine head exhaust valve V for pushing it axially.

[0034] In an intermediate portion of the finger follower is arranged a "normal" roller R free to rotate and in contact with the "normal" cam C for commanding the opening of the exhaust valve V according to said normal operative condition. According to the present invention, the reference point RP is movable according to an auxiliary cam profile AC driven by the engine crankshaft to implement another engine operation, for example, an engine braking strategy, in order to command the opening of the exhaust valve, on or immediately after, the top dead center of its piston, or for example to implement an internal EGR strategy, in order to command the intake valves.

[0035] Said motion of the reference point is realized through an actuator assembly A commanded by said auxiliary cam AC.

[0036] In case the assembly is provided of a HLA, the actuator assembly shift/lift the base/support of the HLA.

[0037] On figure 2 is shown a so called rocker arm RA having two opposite ends 1 and 2.

[0038] The first end 1 is supported by a "normal" cam C, directly or through a pushing rod, which commands the oscillation of the rocker arm for opening the respective exhaust valve during the normal engine operation condition.

[0039] The second end 2 is contact with the stem of the engine head exhaust valve V as for the previous embodiment.

[0040] An intermediate portion of the rocker arm is in contact with a reference point RP acting as a fulcrum for the oscillations, that, according to the present invention is shifted/lifted according to an auxiliary cam profile.

[0041] Also in this case, if the assembly is provided of HLA on the reference point, its base is shifted/lifted according to said auxiliary cam profile.

[0042] In any case, consequently to said shifting, the fulcrum position of the oscillating arm changes, commanding the opening/closing of the valve V according to a second engine operation condition, namely, at least partially overrunning the action of the normal cam.

[0043] For convenience we name as "oscillating arm" either the finger follower FF and also the rocker arm RA.

[0044] In both the embodiments, the three elements V, RP and C develop corresponding forces substantially parallel between each other, on the oscillating arm, and substantially perpendicularly with respect to the development of the oscillating arm itself.

[0045] When the hump of the normal cam C pushes against the arm - finger follower or rocker arm - the latter is forced to move, and in particular to oscillate by pushing

the exhaust or intake valve V against its spring S.

[0046] The cam C is usually supported by a cam shaft CS driven by the crankshaft.

[0047] Both figures 1 and 2 do not show the auxiliary cams, that instead is clearly visible on figure 3 - 6, 9, 10.

[0048] The figures 3 or 4 show a first preferred embodiment of the invention, called for convenience "hydraulic embodiment", where a piston P is directly actuated by the auxiliary cam AC through the auxiliary roller AR for commanding the hydraulic actuator A.

[0049] The piston P is operatively coupled with the actuator A, by means of a hydraulic circuit HC.

[0050] The auxiliary cam AC commands the moving of the piston, by pumping medium towards the actuator A which, in turn, forces the lifting/shifting of the reference point RP of the oscillating arm to oscillate and then the exhaust valve V to open.

[0051] As shown through the figures, the external hollowing of the HLA, where implemented, could define the moving part of piston A.

[0052] Preferably, the auxiliary cam AC is keyed on the cam shaft CS bearing the "normal" cam C.

[0053] When the engine braking strategy or another strategy, as for example internal EGR, is switched on, the hydraulic circuit HC is pressurized, so the piston P is able to command the lifting/lowering of the reference point RP, through the actuator A. Vice versa, when the engine braking strategy is switched off, the hydraulic circuit HC is discharged and the motion of the piston P does not influence the state of the actuator A.

[0054] On figure 5 is shown a configuration similar to the one on figure 3, where also the "normal" cam IC and its corresponding finger follower FF' of the intake valve is shown, with its fixed reference point RP' and its own "normal" cam IC is in contact with the roller IR.

[0055] This is clearly a 2-valve for cylinder scheme, where only the exhaust portion is provided with the auxiliary assembly object of the present invention.

[0056] The same scheme can be implemented also to use a "second operation strategy" on the intake side, by leaving unchanged the behaviour of the exhaust portion.

[0057] It is apparent for the skilled person in the art, that, the present invention can be implemented any additional engine operation, by changing the behaviour of the intake and/or exhaust valves. It is clear that for implementing different strategies in the intake side and exhaust side, two auxiliary cams are needed to independently control the different strategies on the intake and/or exhaust valves.

[0058] On figure 6 is shown a configuration where two valves, for example to intake valves or two exhaust valves, are commanded by the auxiliary cam AC during an auxiliary operation strategy of the combustion engine.

[0059] In the middle of the scheme of figure 6 is arranged the piston P, that commands both the actuators A arranged on its left and right side.

[0060] According to the embodiment on figure 4, the auxiliary roller AR is in contact with the auxiliary cam AC through an auxiliary spring, aging between the auxiliary roller support and a fixed part of the engine head.

[0061] Thus the piston P is always in operation, independently from the pressurization/depressurization of the hydraulic circuit. However, the actuator is commanded only if the hydraulic circuit HC is pressurized.

[0062] According to another embodiment of the invention, that can be combined with the other ones, see figure 7, the hydraulic piston P is of the double-room type. The first room R1 is operatively connected with the hydraulic circuit HC towards the actuator A.

[0063] The second room R2, on the opposite side of the piston is operatively connected with a hydraulic medium source HS, that can be the oil gallery of the combustion engine, usually pressurized by a oil pump.

[0064] The first and second rooms are operatively connected between each other through a two position valve 2PV associated with a check valve CHV.

[0065] The first position (left portion) permits the free flowing of the medium from the first room to the second room, when the piston P is pushed by the braking cam. Thus the piston P lowers and the auxiliary roller could be spaced apart from the auxiliary cam AC. Eventually a spring, shown in figure 7, can be used to avoid the departing of the auxiliary roller form the auxiliary cam.

[0066] The second portion of the valve (right side), instead, permits the hydraulic source HS to pressurize the hydraulic circuit HC, and the check valve prevents the medium from flowing back towards the hydraulic source, when the piston is pushed by the braking cam. Thus the piston P rises and cooperate with the spring, if present, to maintain the auxiliary roller in contact with auxiliary cam AC.

[0067] This solution permits to achieve a really fast response to the first/second auxiliary engine operation strategy.

[0068] On figure 8 is shown another embodiment with a single room R1 piston P. The room R1 is connected either with the hydraulic circuit HC and also with the hydraulic source HS by means of a two position hydraulic valve.

[0069] The first position (left side), as in the previous embodiment, permits the medium to flow back from the hydraulic circuit to the hydraulic source when the piston P is pushed by the braking cam. Thus, the actuator does not receive sufficient pressure to lift its reference point RF.

[0070] This embodiment lacks the braking spring of the previous embodiment. Thus, when the valve is in the first position, the piston remain lifted for effect of the pressurization offered by the hydraulic source HS.

[0071] When the valve passes in its second position, the oil can flow from the hydraulic source to the hydraulic circuit, but it cannot flow back. Thus, when the piston P is pushed, the actuator A is forced to lift its reference point RP.

[0072] This solution is slower in terms of activation time with respect to the previous one, but it assures less pump-

ing losses when the auxiliary strategy is switched off.

[0073] Figure 9 shows the solution of figure 5, through a perspective view. On this figure, also a portion of the valves V is visible. Such valves could be intake or exhaust valve, according to the auxiliary strategy intended to be adopted.

[0074] It should be clear that the auxiliary cam can be keyed on another shaft different form the cam shaft commanding the valves during normal operation. This second shaft receives the rotating motion from the crankshaft as the cam shaft.

[0075] It should be also understood that the invention can be implemented in any manner comprising a braking cam which commands the motion of the reference point of the oscillating arm FF, RA, independently from a finger follower or rocker arm implementation.

[0076] In any case, the normal opening of the exhaust valves is commanded by a conventional or "normal" cam, while the "auxiliary" opening of the exhaust valves is actuated by lifting their respective reference point RP commanded by the auxiliary cam AC.

[0077] It should be also understood that the piston P can be replaced by a first pushing rod, the actuator A with a second pushing rod and living only the interconnection between them commanded through the pressurization/depressurization of a hydraulic actuator or through the activation of an electric actuator.

[0078] According to a "mechanical embodiment" of the invention shown on figure 10, a V-shaped oscillating arm VS, V-arm in the following, has its vertex V hinged to a movable point, while a first end V1 defines a support for the reference point of the finger follower FF and the other end V2 carries an auxiliary roller suitable to contact said auxiliary cam AC. When the vertex V is moved in order to induce the auxiliary roller to properly contact the auxiliary cam, the first end of the V-arm is pushed by the auxiliary cam, that induces the oscillation of the V-arm on the vertex V. As a consequence, the end V1 lifts the reference point RP of the finger follower FF.

[0079] Therefore, the V-arm defines, contemporarily the auxiliary actuator assembly shifting the reference point RP and the connection means between the auxiliary roller and the auxiliary actuator assembly.

[0080] The vertex V of the V-arm can be shifted in several ways. For example through an electrical actuator, or pneumatic one directly connected to the hinging point at the vertex V.

[0081] It is clear that, according to this embodiment, the actuator is not arranged close to the reference point RP, or just under the HLA as for the previous "hydraulic embodiments". In addition, this arrangement can be adapted to be implemented also in a rocker arm scheme.

[0082] According to the figure 10 an auxiliary arm AA is shown, that has an intermediate point FA hinged to a fixed part of the combustion engine head.

[0083] The first end is hinged to the vertex V of the V-arm, while the second, opposite, end V3 is lifted/lowered by an actuator.

[0084] The implementation of the auxiliary arm is really advantageous, even not mandatory, due to the possibility to implement short running but fast actuators, namely piezoelectric actuators. Therefore, the auxiliary arm is capable to amplify the movement of the short running actuator, by shifting the hinging point V of the V-arm.

[0085] It should be also clear that the reference point RP can be moved also according to a required adjustment of the valve lash, for example through the HLA. In this case, the HLA can expand/retract accordingly.

[0086] It is clear that, even not shown, a commanding circuit of the HLA is present.

[0087] Many changes, modifications, variations and other uses and applications of the subject invention will become apparent to those skilled in the art after considering the specification and the accompanying drawings which disclose preferred embodiments thereof. All such changes, modifications, variations and other uses and applications which do not depart from the scope of the invention as defined by the appended claims are deemed to be covered by this invention.

[0088] Further implementation details will not be described, as the man skilled in the art is able to carry out the invention starting from the teaching of the above description.

Claims

1. Auxiliary command assembly for commanding the opening/closing of the head valves (IV, EV) of a combustion engine comprising

- an oscillating arm (FF, RA) having a first end (2) in contact with a valve stem, for pushing it axially during an opening procedure of the valve (V) itself,
- a normal cam (C) driven by a combustion engine crankshaft, coupled with said oscillating arm commanding said oscillation,
- a reference point (RP) defining a fulcrum of said oscillation of the oscillating arm (FF, RA),

the auxiliary command assembly comprising and **characterized in** comprising

- an auxiliary cam (AC) driven by said combustion engine crankshaft,
- an auxiliary roller, suitable to be paired with said auxiliary cam (AC) to follow a profile thereof,
- an actuator assembly (A) suitable to lift/lower said reference point (RP) according to an interaction between said auxiliary cam and said auxiliary roller,
- means for interconnecting said actuator (A) and said auxiliary roller (AR) during an auxiliary engine operating condition, by at least partially overrunning of the commanding action of said

normal cam (C).

2. Assembly according to claim 1, wherein said interconnection means comprise a first hydraulic piston (P) operatively connected with said auxiliary roller (AR), wherein said actuator assembly (A) comprises a second hydraulic piston, and wherein said interconnection means comprise a hydraulic circuit, whose pressurization is controllable according to the activation/deactivation of an auxiliary engine operation.

3. Assembly according to one of previous claims 1 or 2, wherein said assembly comprises HLA means, for adjusting the lash of the valve (V), defining said reference point (RP) and wherein said actuator assembly (A) is suitable to lift/lower said reference point (RP) by moving a support/basis of the HLA means.

4. Assembly according to claim 3, wherein an external hollowing of said HLA define a moving part of said second hydraulic piston.

5. Assembly according to one of the previous claims 2 - 4, wherein said first hydraulic piston (P) is of the double-room type having a first room (R1) operatively connected with said hydraulic circuit (HC), a second opposite room (R2) operatively connected with a hydraulic medium source (HS), wherein the first and second rooms are operatively connected between each other through a control valve (2PV) associated with a check valve (CHV) suitable, according to a first condition, to permit the free flowing of the medium from the first room to the second room and suitable, according to a second condition, to permit the hydraulic source (HS) to pressurize the hydraulic circuit (HC), but preventing the hydraulic medium from flowing back towards the hydraulic source, when the first piston (P) is pushed by the auxiliary cam.

6. Assembly according to one of the previous claims 2 to 4, wherein said hydraulic piston (P) has a single room (R1) connected either with the hydraulic circuit (HC) and also with a hydraulic source (HS) by means of a valve suitable, according to a first condition, to permit the hydraulic medium to flow back from the hydraulic circuit to the hydraulic source, and suitable, according to a second condition, to permit the oil to flow from the hydraulic source to the hydraulic circuit, but not vice versa.

7. Assembly according to claim 1, wherein said actuator assembly (A) and said interconnection means comprise a V-shaped oscillating arm (VS) having its vertex (V) hinged to a movable point, while a second end (V1) defines a support for said reference point (RP) and the other end (V2) carries said auxiliary roller (AR) suitable to contact said auxiliary cam (AC).

8. Assembly according to claim 7, further comprising a further actuator having a movable part hinged to said vertex V, in order to enabling/disabling a motion transfer between the auxiliary cam (AC) and the reference point (RP).

9. Assembly according to claim 7, further comprising an auxiliary arm (AA) having an intermediate point (FA) hinged to a fixed part of the combustion engine head, a second end hinged to the vertex (V) of said V-shaped oscillating arm (VS), while its second, opposite, end (V3) is lifted/lowered by a further actuator, the oscillation of the auxiliary arm enabling/disabling a motion transfer between the auxiliary cam (AC) and the reference point (RP).

10. Assembly according to claims 8 or 9, wherein said further actuator is hydraulic, pneumatic or piezoelectric.

11. Assembly according to any of previous claims from 1 to 10, wherein said head valves (IV, EV) comprise at least a intake valve and said auxiliary cam is shaped and angularly oriented in order to implement an internal EGR operation.

12. Assembly according to any of previous claims from 1 to 10, wherein said head valves (IV, EV) comprise at least an exhaust valve and said auxiliary cam is shaped and angularly oriented in order to implement a decompression engine brake operation.

13. Combustion engine comprising at least one auxiliary command assembly commanding the opening/closing of the head valves (IV, EV) according to claim 11 and/or 12.

14. Terrestrial vehicle comprising a combustion engine according to claim 13.

15. Method for carry out an auxiliary combustion engine operating condition through an assembly commanding the opening/closing of the head valves (IV, EV) of the combustion engine, the method comprising the following steps:

- arranging an auxiliary cam (AC) suitable to be driven by the combustion engine crankshaft,
- arranging an auxiliary roller, suitable to be paired with said auxiliary cam (AC) to follow a profile thereof,
- arranging an actuator assembly (A) suitable to lift/lower a reference point (RP) defining a fulcrum of an oscillating arm (FF, RA) commanding a valve (V), according to an interaction between

said auxiliary cam and said auxiliary roller,
- interconnecting said actuator assembly (A) and said auxiliary roller (AR) during an auxiliary engine operating condition, by at least partially overrunning of the commanding action of a normal cam (C) driving said oscillating arm.

Patentansprüche

1. Hilfssteueranordnung zum Steuern des Öffnens/Schließens der Kopfventile (IV, EV) eines Verbrennungsmotors umfassend:

- einen oszillierenden Arm (FF, RA) mit einem ersten Ende (2) in Kontakt mit einem Ventilschaft, um ihn während eines Öffnungsvorgangs des Ventils (V) selbst axial zu Drücken,
- einen durch eine Verbrennungsmotor-Kurbelwelle angetriebenen normalen Nocken (C), der und mit dem oszillierenden Arm, der die Oszillation steuert, gekoppelt ist,
- einen Referenzpunkt (RP), der einen Drehpunkt der Oszillation des oszillierenden Arms (FF, RA) definiert,

wobei die Hilfssteueranordnung umfasst:

- einen durch die Verbrennungsmotor-Kurbelwelle angetriebenen Hilfsnocken (AC),
- einen Hilfsroller, der geeignet ist, mit dem Hilfsnocken (AC) gepaart zu werden, um einem Profil davon zu folgen,
- eine Aktuatoranordnung (A), die geeignet ist, den Referenzpunkt (RP) gemäß einer Interaktion zwischen dem Hilfsnocken und dem Hilfsroller zu heben/senken,
- Mittel zum Koppeln des Aktuators (A) und des Hilfsrollers (AR) während eines Hilfsmotorbetriebszustands durch zumindest teilweises Überlaufen der Steueraktion des normalen Nockens (C).

2. Anordnung gemäß Anspruch 1, wobei die Kopplungsmittel einen ersten hydraulischen Kolben (P) aufweisen, der operativ mit dem Hilfsroller (AR) verbunden ist, wobei die Aktuatoranordnung (A) einen zweiten hydraulischen Kolben umfasst, und wobei die Kopplungsmittel einen hydraulischen Kreislauf umfassen, dessen Druckbeaufschlagung gemäß der Aktivierung/Deaktivierung eines Hilfsmotorbetriebs steuerbar ist.

3. Anordnung gemäß einem der vorhergehenden Ansprüche 1 oder 2, wobei die Anordnung HLA-Mittel zum Anpassen des Spiels des Ventils (V) umfasst, die den Referenzpunkt (RP) definieren, und wobei die Aktuatoranordnung (A) geeignet ist, den Referenzpunkt (RP) durch Bewegen einer Auflage/Basis der HLA-Mittel zu definieren.

4. Anordnung gemäß Anspruch 3, wobei eine externe Auskehlung des HLA einen beweglichen Teil des zweiten hydraulischen Kolbens definiert.

5. Anordnung gemäß einem der vorhergehenden Ansprüche 2-4, wobei der erste hydraulische Kolben (P) einer des Doppelraumtyps mit einem ersten Raum (R1) ist, der operativ mit dem hydraulischen Kreislauf (HC) verbunden ist, einem zweiten gegenüberliegenden Raum (R2), der operativ mit einer Quelle für hydraulisches Medium (HS) verbunden ist, wobei die ersten und zweiten Räume operativ über ein Steuerventil (2PV) miteinander verbunden sind, welches mit einem Rückschlagventil (CHV) verbunden ist, welches gemäß einem ersten Zustand geeignet ist, den freien Fluss des Mediums vom ersten Raum zum zweiten Raum zu erlauben, und welches gemäß einem zweiten Zustand geeignet ist, der hydraulischen Quelle (HS) zu erlauben, den hydraulischen Kreislauf (HC) mit Druck zu beaufschlagen, jedoch zu verhindern, dass das hydraulische Medium zurück zur hydraulischen Quelle fließt, wenn der erste Kolben (P) durch den Hilfsnocken gedrückt wird.

6. Anordnung gemäß einem der vorhergehenden Ansprüche 2 bis 4, wobei der hydraulische Kolben (P) einen einzelnen Raum (R1) aufweist, der entweder mit dem hydraulischen Kreislauf (HC) und ebenso mit einer hydraulischen Quelle (HS) mittels eines Ventils verbunden ist, welches gemäß einem ersten Zustand geeignet ist, dem Medium zu erlauben, vom hydraulischen Kreislauf in die hydraulische Quelle zurückzufließen, und welches gemäß einem zweiten Zustand geeignet ist, dem Öl zu erlauben, von der hydraulischen Quelle in den hydraulischen Kreislauf zu fließen, jedoch nicht umgekehrt.

7. Anordnung gemäß Anspruch 1, wobei die Aktuatoranordnung (A) und die Kopplungsmittel einen V-förmigen oszillierenden Arm (VS) aufweisen, dessen Spitze (V) drehbar an einem beweglichen Punkt angebracht ist, während ein zweites Ende (V1) eine Auflage für den Referenzpunkt (RP) definiert und das andere Ende den Hilfsroller (AR) trägt, der geeignet ist, den Hilfsnocken (AC) zu kontaktieren.

8. Anordnung gemäß Anspruch 7, ferner aufweisend einen weiteren Aktuator mit einem beweglichen Teil, welcher drehbar an die Spitze V angebracht ist, um einen Bewegungstransfer zwischen dem Hilfsnocken (AC) und dem Referenzpunkt (RP) zu ermöglichen/unterbinden.

9. Anordnung gemäß Anspruch 7, ferner aufweisend

einen Hilfsarm (AA) mit einem Zwischenpunkt (FA), der drehbar an einem festen Teil des Verbrennungsmotorkopfs angebracht ist, einem zweiten Ende, welches drehbar an die Spitze (V) des V-förmigen oszillierenden Arms (VS) angebracht ist, während sein zweites, gegenüberliegendes Ende (V3) durch einen weiteren Aktuator gehoben/gesenkt wird, wobei die Oszillation des Hilfsarms einen Bewegungstransfer zwischen dem Hilfsnocken (AC) und dem Referenzpunkt (RP) ermöglicht/unterbindet.

10. Anordnung gemäß den Ansprüchen 8 oder 9, wobei der weitere Aktuator hydraulisch, pneumatisch oder piezoelektrisch ist.

11. Anordnung gemäß einem der vorhergehenden Ansprüche von 1 bis 10, wobei die Kopfventile (IV, EV) zumindest ein Einlassventil aufweisen und der Hilfsnocken geformt und winkelförmig orientiert ist, um einen internen EGR-Betrieb zu implementieren.

12. Anordnung gemäß einem der vorhergehenden Ansprüche 1 bis 10, wobei die Kopfventile (IV, EV) zumindest ein Auslassventil aufweisen und der Hilfsnocken geformt und winkelförmig orientiert ist, um einen Dekompressionsmotorbremse-Betrieb zu implementieren.

13. Verbrennungsmotor umfassend zumindest eine Hilfssteueranordnung gemäß Anspruch 11 und/oder 12, die das Öffnen/Schließen der Kopfventile (IV, EV) steuert.

14. Terrestrisches Fahrzeug umfassend einen Verbrennungsmotor gemäß Anspruch 13.

15. Verfahren zum Ausführen eines Hilfsverbrennungsmotor-Betriebszustands über eine Anordnung, die das Öffnen/Schließen der Kopfventile (IV, EV) des Verbrennungsmotors steuert, wobei das Verfahren die folgenden Schritte umfasst:

- Anordnen eines Hilfsnocken (AC), der geeignet ist, durch die Verbrennungsmotor-Kurbelwelle angetrieben zu werden,
- Anordnen eines Hilfsrollers, der geeignet ist, mit dem Hilfsnocken (AC) gepaart zu werden, um einem Profil davon zu folgen,
- Anordnen einer Aktuatoranordnung (A), die geeignet ist, einen Referenzpunkt (RP), der einen Drehpunkt eines oszillierenden Arms (FF, RA), der ein Ventil (V) steuert, definiert, zu heben/senken, gemäß einer Interaktion zwischen dem Hilfsnocken und dem Hilfsroller,
- Koppeln der Aktuatoranordnung (A) und des Hilfsrollers (AR) während eines Hilfsmotorbetriebszustands durch zumindest teilweises Überlaufen der Steueraktion eines normalen Nockens (C), der den oszillierenden Arm antreibt.

Revendications

1. Ensemble de commande auxiliaire pour commander l'ouverture/la fermeture des soupapes principales (IV, EV) d'un moteur à combustion comprenant

- un bras oscillant (FF, RA) ayant une première extrémité (2) en contact avec une tige de soupape, pour la pousser axialement pendant une procédure d'ouverture de la soupape (V) elle-même,
- une came normale (C) entraînée par un vilebrequin de moteur à combustion, couplée audit bras oscillant commandant ladite oscillation,
- un point de référence (RP) définissant un pivot de ladite oscillation du bras oscillant (FF, RA),

l'ensemble de commande auxiliaire comprenant et **caractérisé en ce qu'**il comprend

- une came auxiliaire (AC) entraînée par ledit vilebrequin de moteur à combustion,
- un rouleau auxiliaire, adapté pour être apparié avec ladite came auxiliaire (AC) pour suivre un profil de celle-ci,
- un ensemble d'actionneur (A) adapté pour soulever/abaisser ledit point de référence (RP) selon une interaction entre ladite came auxiliaire et ledit rouleau auxiliaire,
- un moyen pour interconnecter ledit actionneur (A) et ledit rouleau auxiliaire (AR) pendant une condition de fonctionnement de moteur auxiliaire, par dépassement au moins partiel de l'action de commande de ladite came normale (C).

2. Ensemble selon la revendication 1, dans lequel lesdits moyens d'interconnexion comprennent un premier piston hydraulique (P) relié fonctionnellement audit rouleau auxiliaire (AR), dans lequel ledit ensemble d'actionneur (A) comprend un deuxième piston hydraulique, et dans lequel lesdits moyens d'interconnexion comprennent un circuit hydraulique, dont la pressurisation est contrôlable selon l'activation/la désactivation d'un fonctionnement de moteur auxiliaire.

3. Ensemble selon l'une des revendications précédentes 1 ou 2, dans lequel ledit ensemble comprend un moyen HLA, pour l'ajustage du jeu de la soupape (V), définissant ledit point de référence (RP) et dans lequel ledit ensemble d'actionneur (A) est adapté pour soulever/abaisser ledit point de référence (RP) par déplacement d'un support/d'une base du moyen HLA.

4. Ensemble selon la revendication 3, dans lequel un évidement externe dudit HLA définit une partie mobile dudit deuxième piston hydraulique.

5. Ensemble selon l'une des revendications précédentes 2 - 4, dans lequel ledit premier piston hydraulique (P) est de type double chambre ayant une première chambre (R1) reliée fonctionnellement audit circuit hydraulique (HC), une deuxième chambre opposée (R2) reliée fonctionnellement à une source de milieu hydraulique (HS), dans lequel les première et deuxième chambres sont reliées fonctionnellement entre elles par le biais d'une soupape de commande (2PV) associée à une soupape de contrôle (CHV) adaptée, selon une première condition, pour permettre l'écoulement libre du milieu de la première chambre à la deuxième chambre et adaptée, selon une deuxième condition, pour permettre à la source hydraulique (HS) de mettre sous pression le circuit hydraulique (HC), mais empêchant le milieu hydraulique de refluer vers la source hydraulique, lorsque le premier piston (P) est poussé par la came auxiliaire.

6. Ensemble selon l'une des revendications précédentes 2 à 4, dans lequel ledit piston hydraulique (P) a une seule chambre (R1) reliée soit au circuit hydraulique (HC) et aussi à une source hydraulique (HS) au moyen d'une soupape adaptée, selon une première condition, pour permettre au milieu hydraulique de refluer du circuit hydraulique à la source hydraulique, et adaptée, selon une deuxième condition, pour permettre à l'huile de s'écouler de la source hydraulique au circuit hydraulique, mais pas inversement.

7. Ensemble selon la revendication 1, dans lequel ledit ensemble d'actionneur (A) et ledit moyen d'interconnexion comprennent un bras oscillant en forme de V (VS) ayant son sommet (V) articulé à un point mobile, pendant qu'une deuxième extrémité (V1) définit un support pour ledit point de référence (RP) et l'autre extrémité (V2) porte ledit rouleau auxiliaire (AR) adapté pour entrer en contact avec ladite came auxiliaire (AC).

8. Ensemble selon la revendication 7, comprenant en outre un autre actionneur ayant une partie mobile articulée audit sommet V, afin d'activer/de désactiver un transfert de mouvement entre la came auxiliaire (AC) et le point de référence (RP).

9. Ensemble selon la revendication 7, comprenant en outre un bras auxiliaire (AA) ayant un point intermédiaire (FA) articulé à une partie fixe de la culasse de moteur à combustion, une deuxième extrémité articulée au sommet (V) dudit bras oscillant en forme de V (VS), pendant que sa deuxième extrémité opposée (V3) est soulevée/abaissée par un autre actionneur, l'oscillation du bras auxiliaire activant/désactivant un transfert de mouvement entre la came auxiliaire (AC) et le point de référence (RP).

10. Ensemble selon les revendications 8 ou 9, dans lequel ledit autre actionneur est hydraulique, pneumatique ou piézoélectrique.

11. Ensemble selon l'une quelconque des revendications précédentes 1 à 10, dans lequel lesdites soupapes principales (IV, EV) comprennent au moins une soupape d'admission et ladite came auxiliaire est façonnée et orientée angulairement afin de mettre en oeuvre une opération EGR interne.

12. Ensemble selon l'une quelconque des revendications précédentes 1 à 10, dans lequel lesdites soupapes principales (IV, EV) comprennent au moins une soupape d'échappement et ladite came auxiliaire est formée et orientée angulairement afin de mettre en oeuvre une opération de freinage d'un moteur de décompression.

13. Moteur à combustion comprenant au moins un ensemble de commande auxiliaire commandant l'ouverture/la fermeture des soupapes principales (IV, EV) selon la revendication 11 et/ou 12.

14. Véhicule terrestre comprenant un moteur à combustion selon la revendication 13.

15. Méthode de réalisation d'une condition de fonctionnement de moteur à combustion auxiliaire par le biais d'un ensemble commandant l'ouverture/la fermeture des soupapes principales (IV, EV) du moteur à combustion, la méthode comprenant les étapes suivantes :

- agencement d'une came auxiliaire (AC) adaptée pour être entraînée par le vilebrequin de moteur à combustion,
- agencement d'un rouleau auxiliaire, adapté pour être apparié avec ladite came auxiliaire (AC) pour suivre un profil de celle-ci,
- agencement d'un ensemble d'actionneur (A) adapté pour soulever/abaisser un point de référence (RP) définissant un pivot d'un bras oscillant (FF, RA) commandant une soupape (V), selon une interaction entre ladite came auxiliaire et ledit rouleau auxiliaire,
- interconnexion dudit ensemble d'actionneur (A) et dudit rouleau auxiliaire (AR) pendant une condition de fonctionnement de moteur auxiliaire, par dépassement au moins partiel de l'action de commande d'une came normale (C) entraînant ledit bras oscillant.

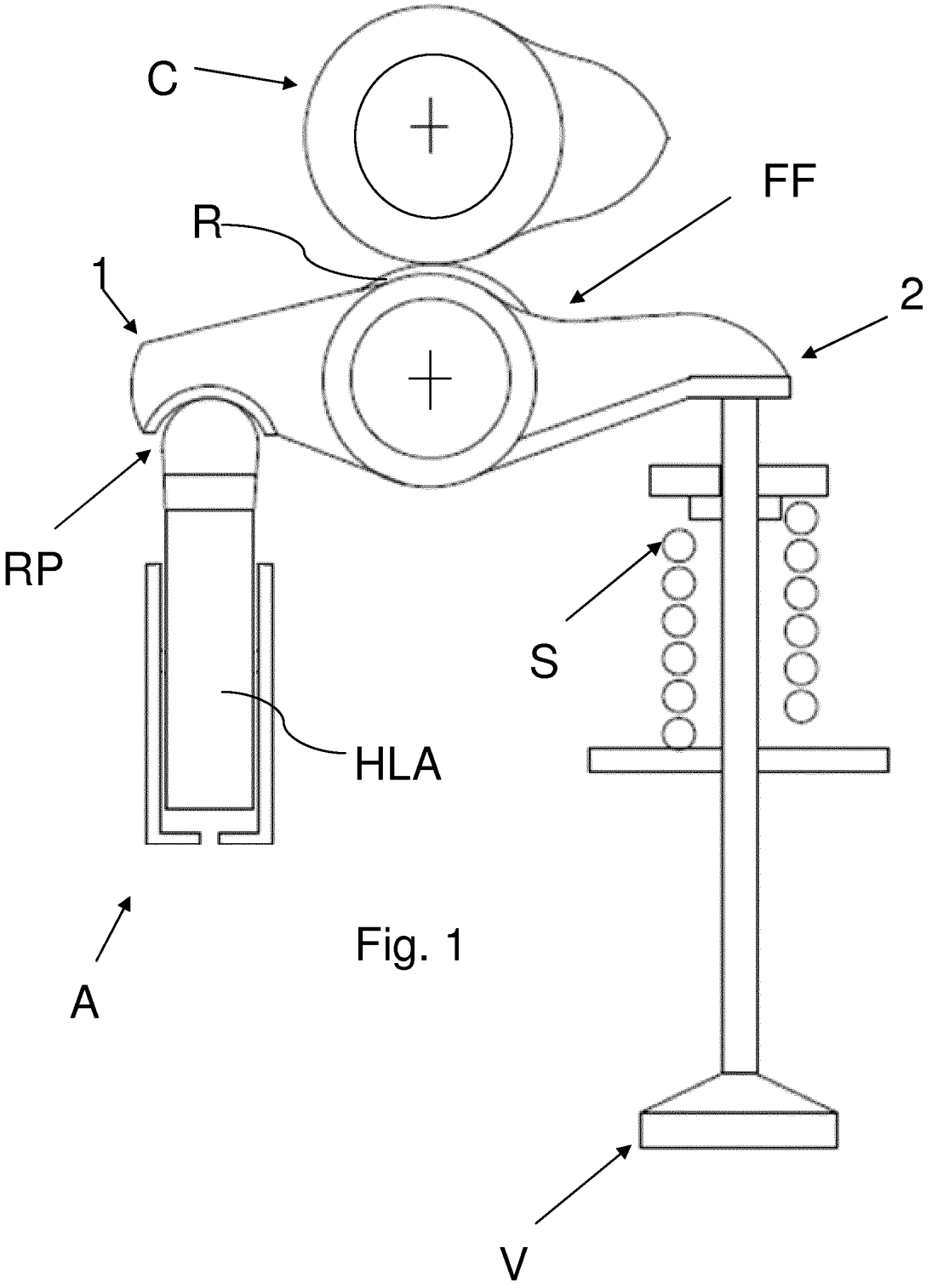

Fig. 1

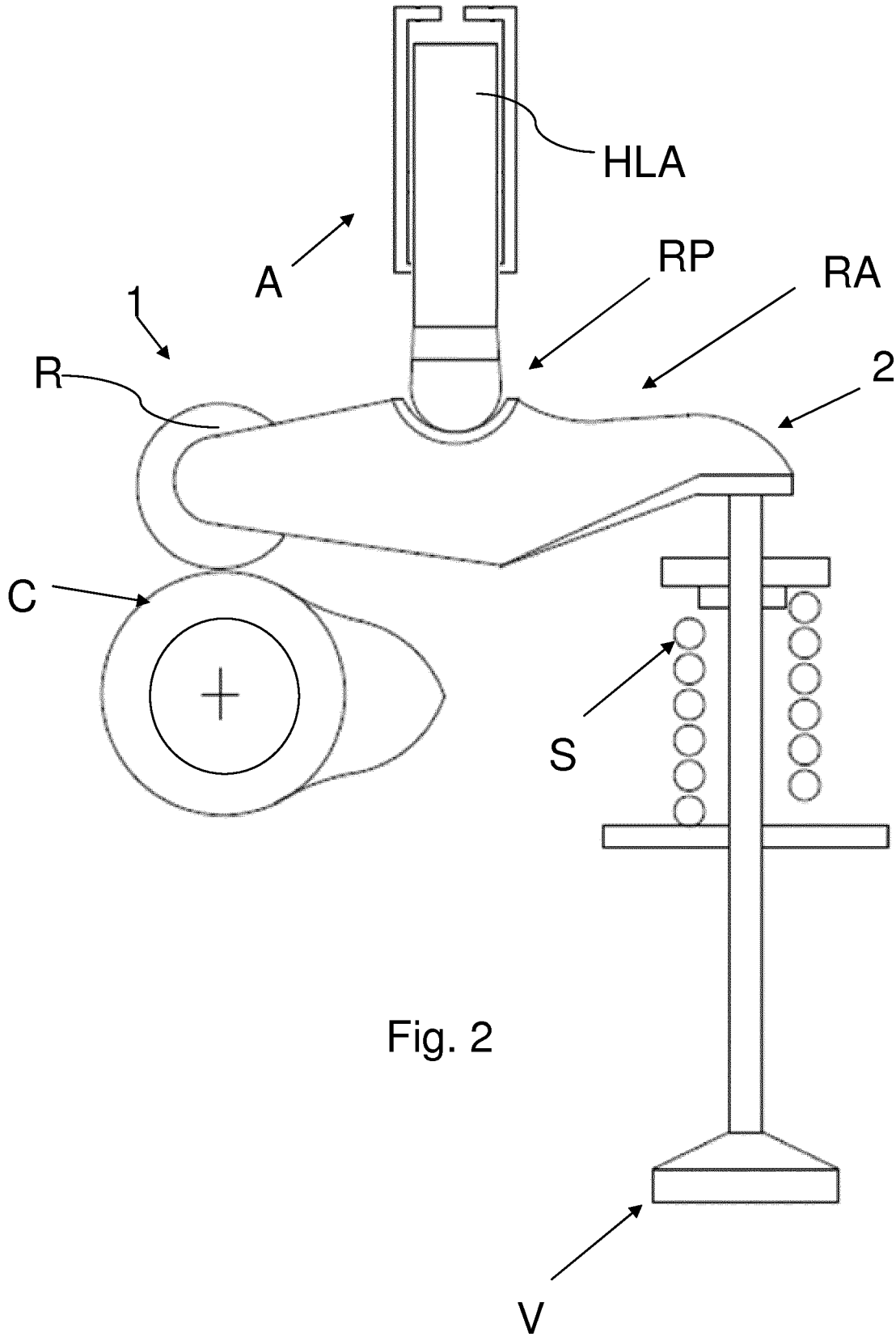

Fig. 2

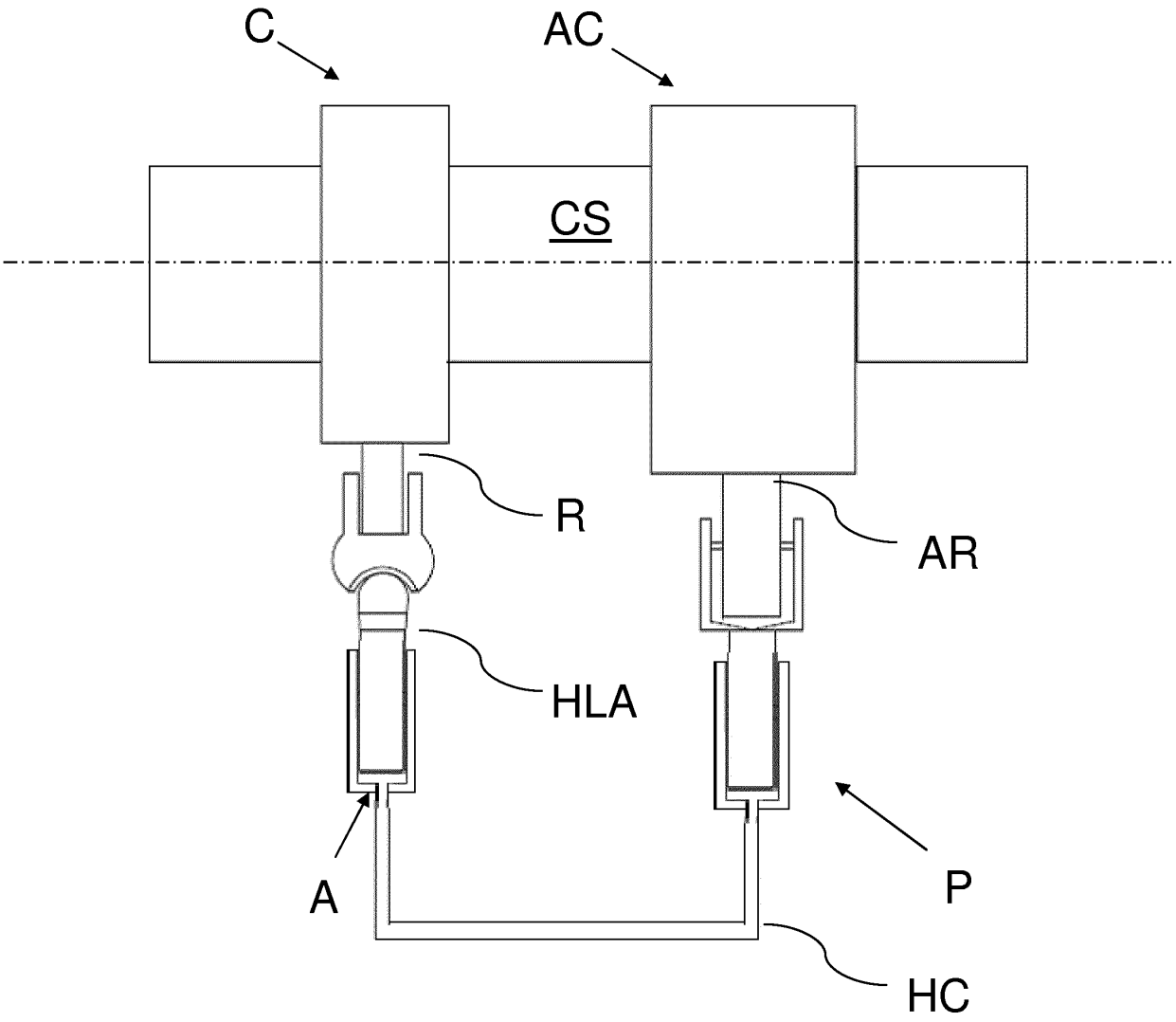

Fig. 3

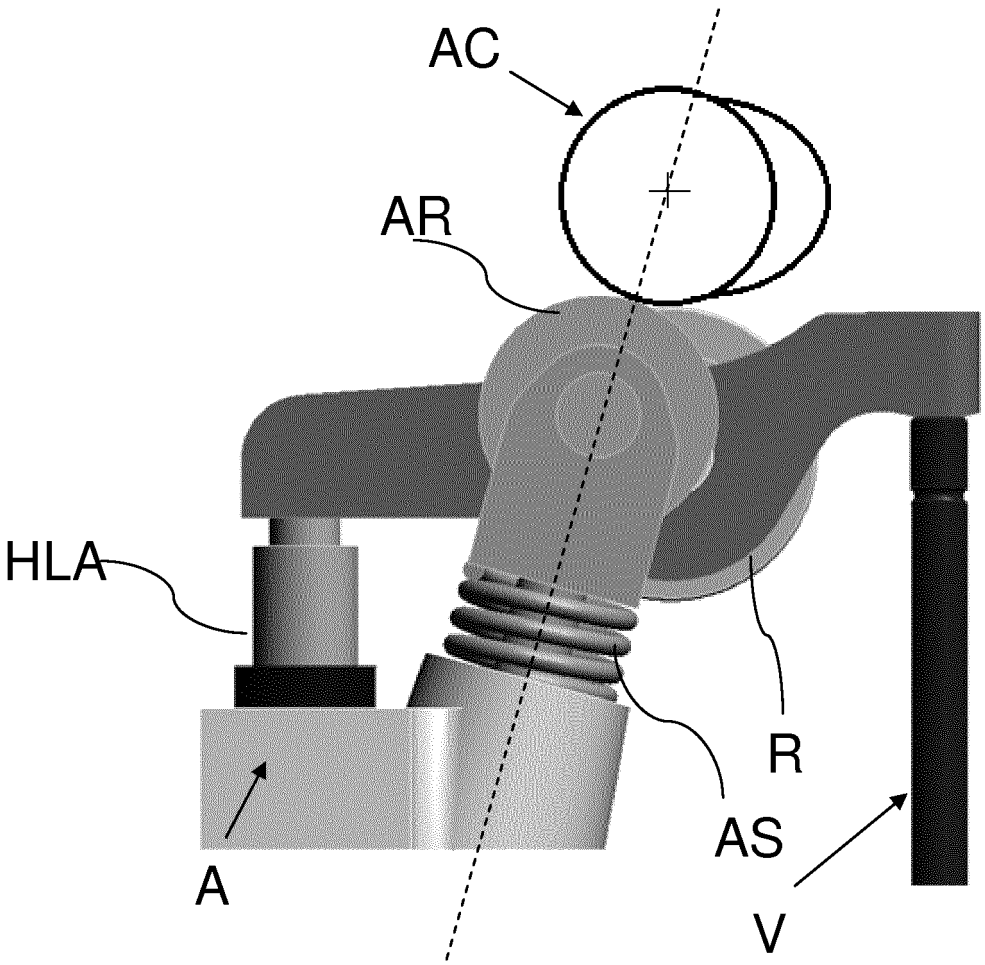

Fig. 4

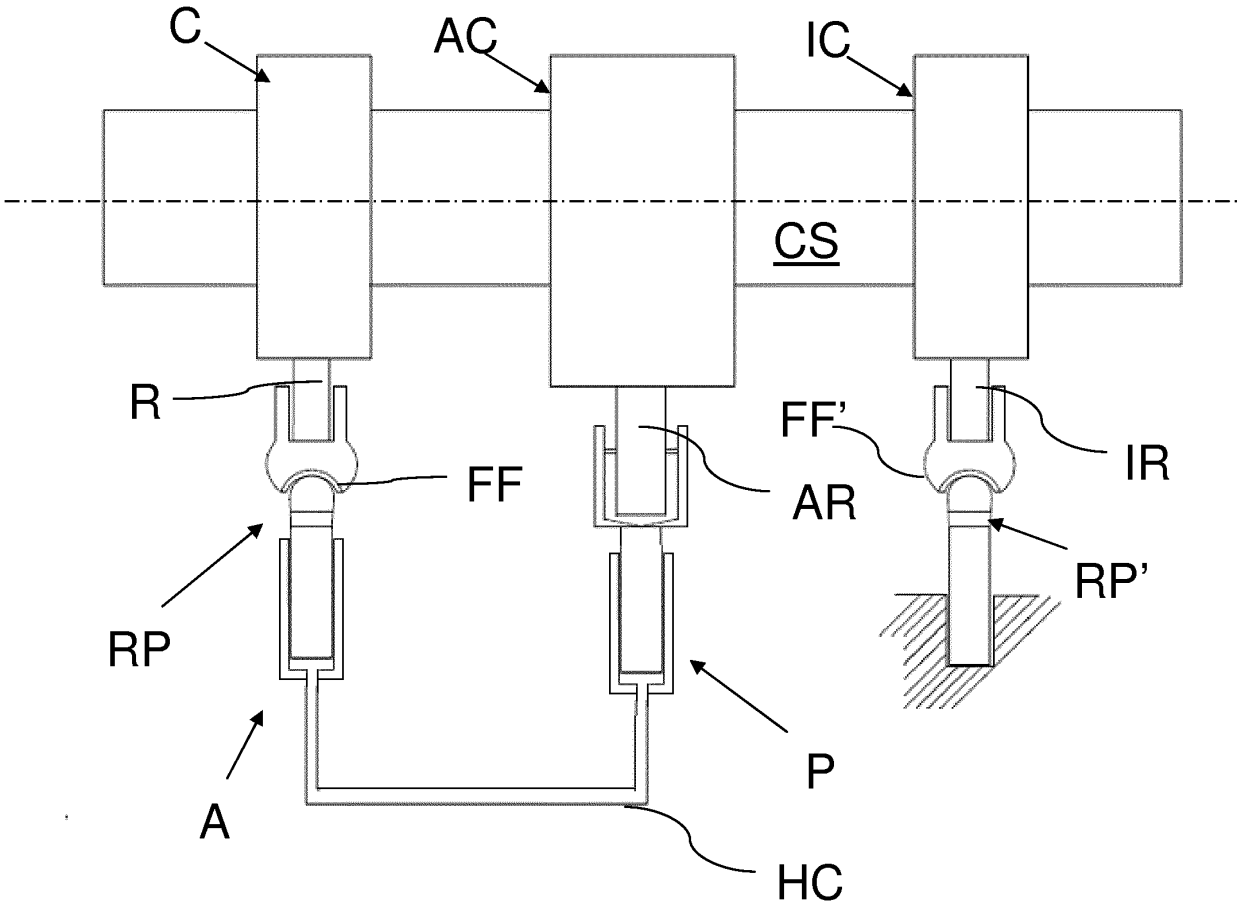

Fig. 5

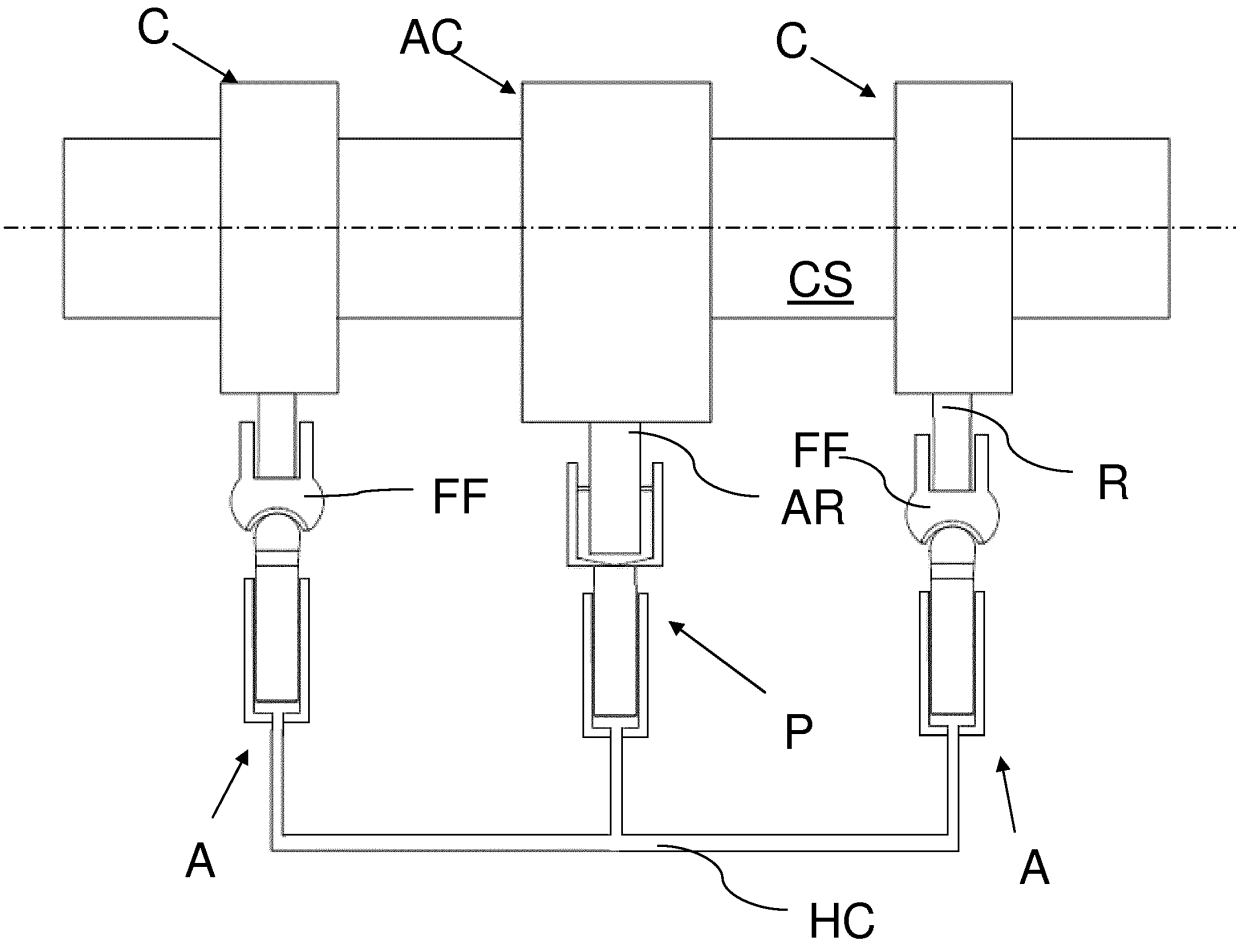

Fig. 6

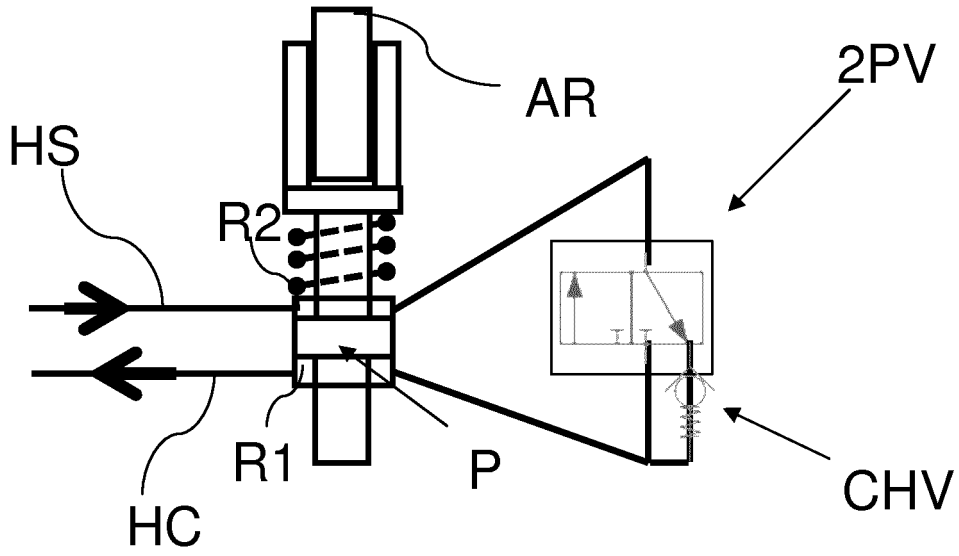

Fig. 7

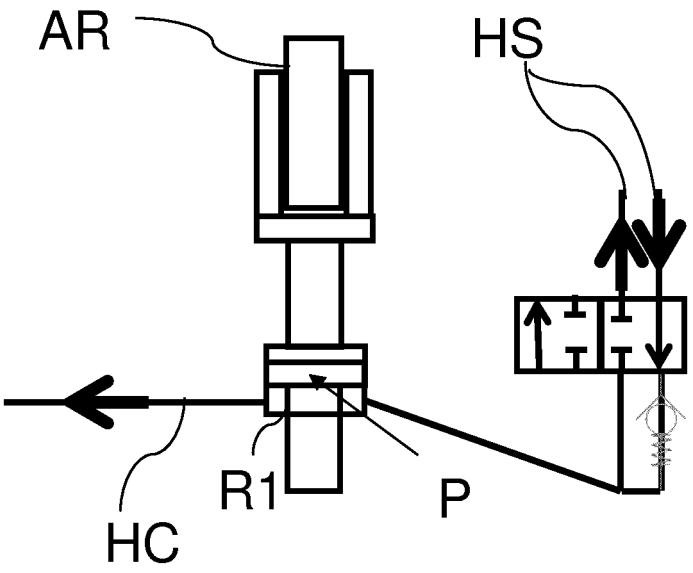

Fig. 8

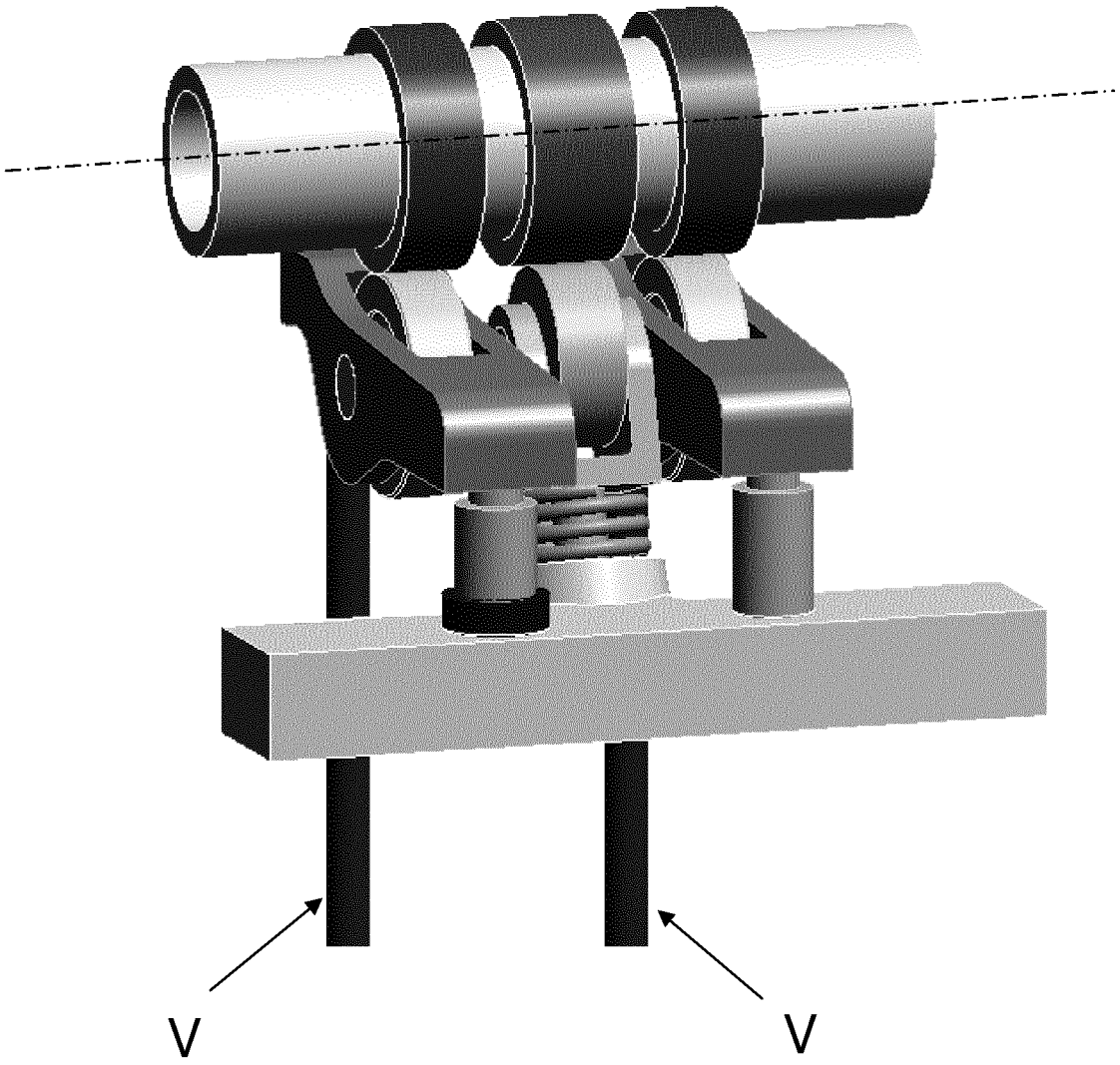

Fig. 9

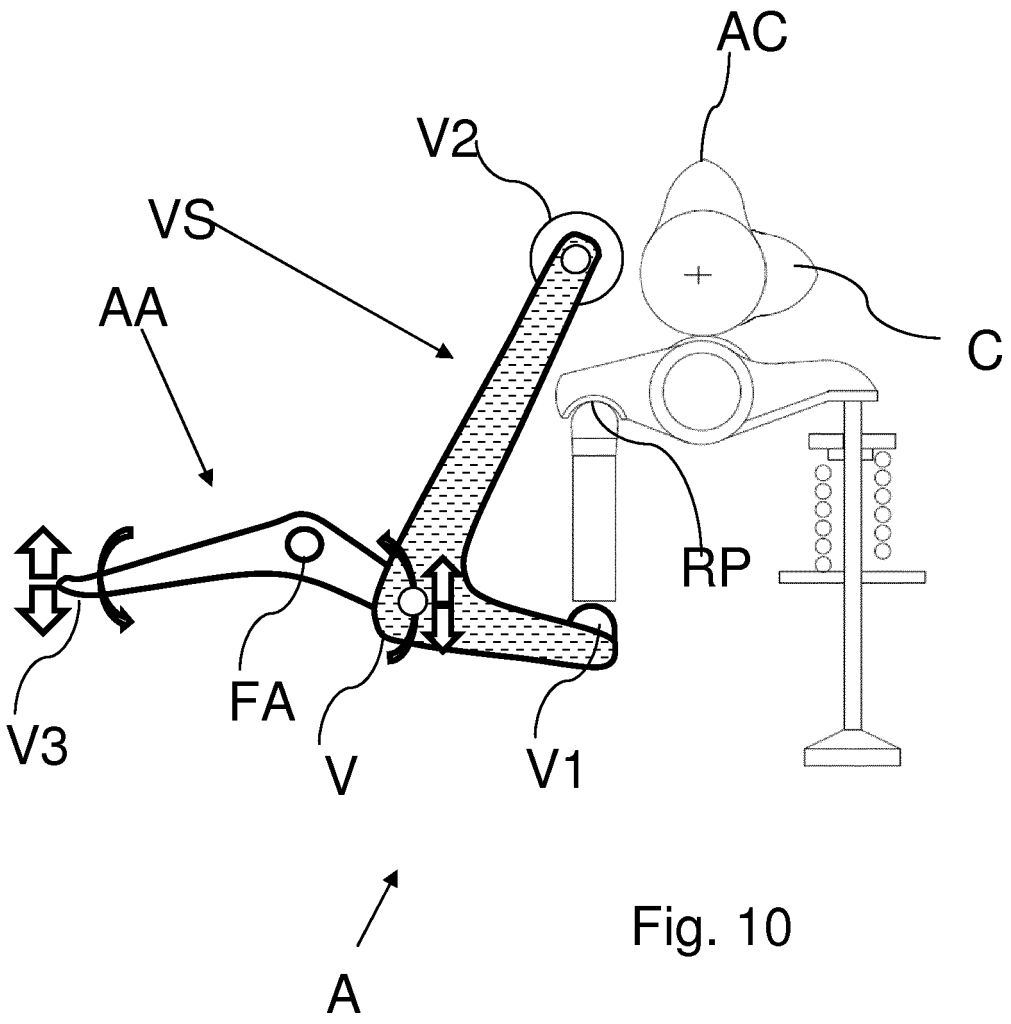

Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4615307 A **[0002]**