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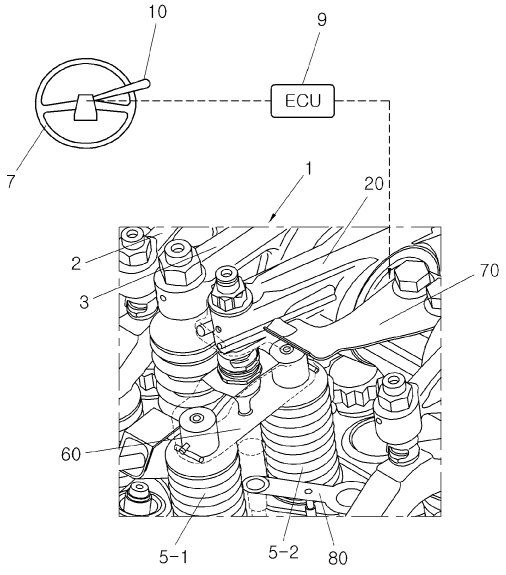
(54) Integrated engine brake

(57) An integrated engine brake assembly may include a valve that forces oil circulating through an engine to flow to an exhaust rocker arm when an engine brake lever is operated, a bridge that forms an interval with a pair of first and second exhaust valves installed on a combustion chamber, an internal oil flow path which supplies the oil flowing toward the exhaust rocker arm to the bridge through an internal space of the exhaust rocker arm, and along which the oil is supplied to the bridge and brings the bridge into contact with the pair of first and second exhaust valves under pressure, and a protrusion lifting up the exhaust rocker arm at a compression top dead center so that the pair of first and second exhaust valves are pressed and opened forcibly by the bridge, and the bridge is pressed by seesaw movement of the exhaust rocker arm.

FIG.1A



EP 2 868 876 A1

Description

CROSS-REFERENCE(S) TO RELATED APPLICATIONS

[0001] The present application claims priority to Korean Patent Application No. 10-2013-0121171, filed on October 11, 2013, the entire contents of which is incorporated herein for all purposes by this reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] Exemplary embodiments of the present invention relate to an engine brake and, more particularly, to an integrated engine brake in which a structure associated with a valve mechanism such as an exhaust rocker arm or a cam shaft is formed, thereby decreasing a size along with weight to provide a more compact configuration.

Description of Related Art

[0003] In general, since large commercial vehicles cannot secure a sufficient braking force using only a foot brake which catches and restrains wheels, various auxiliary brakes are further mounted.

[0004] Such auxiliary brakes are based on a principle in which power transmitted to a crankshaft during intake-compression-expansion-exhaust strokes of combustion strokes of an engine is reduced to further secure the braking force.

[0005] The auxiliary brakes may include an engine brake, a jake brake, and an exhaust brake by way of example.

[0006] Among them, the engine brake has a mode in which vacuum pressure resistance applied to a piston during an intake stroke, compression resistance during a compression stroke, compression resistance during an exhaust stroke, and a mechanical frictional force generated when the engine rotates are used as a braking force.

[0007] For example, in the mode, a driving force of a vehicle is generated during typical travelling in which the intake-compression-explosion-exhaust strokes are normally performed, but an exhaust valve is forcibly opened at a compression top dead center while an accelerator pedal is released, and thereby the vehicle is decelerated.

[0008] Such deceleration of the vehicle occurs because, while air compressed at the compression top dead center is discharged into the atmosphere, the compressed air does not push down the piston, to prevent generation of the driving force.

[0009] On the other hand, when the exhaust valve is not opened at the compression top dead center while the accelerator pedal is released, the piston consumes a predetermined amount of energy (driving force) while compressing the air that has entered a cylinder during the intake stroke during the compression stroke. However, the air compressed in the cylinder is expanded to push down the piston again during the explosion stroke, and generates a predetermined amount of energy (driving force). Thereby, the deceleration hardly takes place. In this case, since the fuel is not ignited or burnt spontaneously in the cylinder, no explosion occurs.

[0010] Typically, the engine brakes are formed on an upper portion of the engine along with a valve mechanism, and circulate oil to operate an exhaust rocker arm when activated. Thus, the exhaust rocker arm presses the exhaust valve, and thereby an exhaust gas in a combustion chamber is forcibly discharged.

[0011] However, the engine brakes are not at all structurally associated with the valve mechanism such as the rocker arm or the cam shaft while controlling the operation of the rocker arm of the valve mechanism on the upper portion of the engine, are manufactured as a separate assembly, and are installed on the upper portion of the engine so that the manufactured separate assembly is connected to the valve mechanism.

[0012] For this reason, the engine brakes are increased in weight, particularly in size because all of a solenoid valve, a control valve, master and slave pistons, and an oil circulation path are incorporated into a housing. Thus, it is obvious that such engine brakes are disadvantageous to commercial vehicle engines in which exhaust regulation and improvement of fuel efficiency are required.

[0013] Furthermore, since two cylinders are controlled by one engine brake, a six-cylinder engine should be mounted with three engine brakes. For this reason, it is obvious that such engine brakes are further disadvantageous to the commercial vehicle engines which have high horsepower and high torque, which is decreased in size, and in which the exhaust regulation and the improvement of fuel efficiency are required.

[0014] The information disclosed in this Background of the Invention section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

BRIEF SUMMARY

[0015] Various aspects of the present invention are directed to providing an integrated engine brake in which an oil channel is formed using an exhaust rocker arm configured to activate an exhaust valve during an exhaust stroke, and thereby weight is reduced along with a size, and can be easily applied to a commercial vehicle engine which has high horsepower and high torque, which is decreased in size, and in which the exhaust regulation and the improvement of fuel efficiency are required, due to a compact configuration resulting from the reduction in weight and size.

[0016] In order to accomplish the above object, the

present invention provides an integrated engine brake is characterized by including, a valve that forces oil circulating through an engine to flow to an exhaust rocker arm when an engine brake lever is operated, a bridge that forms an interval with a pair of first and second exhaust valves installed on a combustion chamber, an internal oil flow path which supplies the oil flowing toward the exhaust rocker arm to the bridge through an internal space of the exhaust rocker arm, and along which the oil is supplied to the bridge and brings the bridge into contact with the pair of first and second exhaust valves under pressure, a protrusion that lifts up the exhaust rocker arm at a compression top dead center so that the pair of first and second exhaust valves are pressed and opened forcibly by the bridge, and the bridge is pressed by seesaw movement of the exhaust rocker arm.

[0017] The internal oil flow path may include an oil inlet that is formed in a shaft hole of the exhaust rocker arm and into which the oil that flows toward the exhaust rocker arm flows, an oil flow path that is formed inside the exhaust rocker arm so that an oil flow of the oil inlet leads to an end portion of the exhaust rocker arm, and an oil outlet that is connected to the oil flow path so that the oil flowing into the oil flow path is discharged to the bridge.

[0018] The oil outlet may be formed in an adjustor bolt, and the adjustor bolt may be coupled to the exhaust rocker arm and come into contact with the bridge.

[0019] The oil outlet may be formed in an internal space of the adjustor bolt in an axial direction, and the oil outlet may communicate with the oil flow path through a circumferential hole of the adjustor bolt.

[0020] The bridge may include a chamber that is filled with the oil discharged from the oil outlet to form oil pressure, a pair of first and second master pistons that are housed in the chamber to be lowered due to the oil pressure of the chamber and come into contact with the pair of first and second exhaust valves, a reset pin, a portion of which is exposed to an outside of the chamber and comes into contact with a reset bar so that the oil within the chamber is discharged to the outside.

[0021] The chamber may include a plug having a plug chamber oil inlet into which the oil discharged from the oil outlet flows, and which discharges the oil to the chamber.

[0022] The pair of first and second master pistons may be housed in the pair of first and second piston chambers in which the oil pressure is formed, and the pair of first and second piston chambers may be connected to a pair of first and second oil diffusion paths which extend toward both of left and right ends of the chamber.

[0023] The exhaust rocker arm may further include a bias spring, and the bias spring presses the exhaust rocker arm so that the adjustor bolt coupled to the exhaust rocker arm comes into contact with the bridge.

[0024] The protrusion may be located on a lower portion of the exhaust rocker arm, and protrude from an outer circumferential surface of a rotated exhaust cam.

[0025] The protrusion may come into contact with an exhaust rocker arm roller, and the exhaust rocker arm roller may be formed on the exhaust rocker arm.

[0026] The methods and apparatuses of the present invention have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIGS. 1A and 1B show a configuration of an integrated engine brake according to an exemplary embodiment of the present invention.

FIG. 2 shows a configuration in which an oil supply member of the integrated engine brake according to an exemplary embodiment of the present invention is monolithically formed with an exhaust rocker arm.

FIG. 3 shows a detailed configuration of a bridge associated with the oil supply member of FIG. 2.

FIG. 4 shows a state in which the integrated engine brake according to an exemplary embodiment of the present invention is activated by an oil flow and pressure until a piston reaches a compression top dead center.

FIGS. 5A to 5C show a state in which an exhaust valve of the integrated engine brake according to an exemplary embodiment of the present invention is forcibly opened, and then returned to an original state.

[0028] It should be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the invention. The specific design features of the present invention as disclosed herein, including, for example, specific dimensions, orientations, locations, and shapes will be determined in part by the particular intended application and use environment.

[0029] In the figures, reference numbers refer to the same or equivalent parts of the present invention throughout the several figures of the drawing.

DETAILED DESCRIPTION

[0030] Reference will now be made in detail to various embodiments of the present invention(s), examples of which are illustrated in the accompanying drawings and described below. While the invention(s) will be described in conjunction with exemplary embodiments, it will be un-

derstood that the present description is not intended to limit the invention(s) to those exemplary embodiments. On the contrary, the invention(s) is/are intended to cover not only the exemplary embodiments, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the invention as defined by the appended claims.

[0031] FIGS. 1A and 1B show a configuration of an integrated engine brake according to an exemplary embodiment of the present invention.

[0032] As shown in FIGS. 1A and 1B, the engine brake includes an engine brake lever 10, an oil supply member 20, an adjustor bolt 50, a bridge 60, a bias spring 70, a reset bar 80, and a lifter 90.

[0033] The engine brake lever 10 is installed on a steering wheel 7 and generates an On/Off signal.

[0034] The oil supply member 20 forms a flow path in which engine oil flows through an exhaust rocker arm 3 when the engine brake lever 10 is switched on. The exhaust rocker arm 3 is a member of a valve mechanism 1 that is installed on an upper portion of the engine and opens/closes a pair of first and second exhaust valves 5-1 and 5-2 installed on each cylinder of the engine.

[0035] The adjustor bolt 50 is cooperated with movement of the exhaust rocker arm 3 and functions as a path through the engine oil supplied from the oil supply member 20 is discharged to the bridge 60.

[0036] The bridge 60 presses the pair of first and second exhaust valves 5-1 and 5-2 due to an action of the introduced engine oil, thereby forcibly discharging a combustion gas within the cylinder.

[0037] The bias spring 70 presses the exhaust rocker arm 3 so that the adjustor bolt 50 and the bridge 60 are brought into contact with each other.

[0038] The reset bar 80 is located on a lower portion of the bridge 60 so as to discharge the engine oil within the bridge 60 at a predetermined point in time.

[0039] The lifter 90 raises the exhaust rocker arm 3 at a compression top dead center. To this end, the lifter 90 includes an exhaust cam 91, an exhaust rocker arm roller 93, and a protrusion 90-1 installed between them, and the protrusion 90-1 protrudes from an outer circumferential surface of the exhaust cam 91 at a position of the compression top dead center.

[0040] FIG. 2 shows a detailed configuration of the oil supply member 20.

[0041] As shown in FIG. 2, the oil supply member 20 includes a valve 30 that opens an engine oil flow path 4a when the engine brake lever 10 is operated, and an internal oil flow path 40 that forms a path of the introduced engine oil.

[0042] The valve 30 blocks the engine oil flow path 4a of a rocker arm shaft 4 and then opens the engine oil flow path 4a when the engine brake lever 10 is operated. A solenoid type is applied to the valve 30.

[0043] The internal oil flow path 40 includes an oil inlet 41, an oil flow path 43, and an oil outlet 45.

[0044] The oil inlet 41 is formed in a shaft hole of the exhaust rocker arm 3 to which the rocker arm shaft 4 is coupled. The oil flow path 43 is formed inside the exhaust rocker arm 3 so that the oil flowing into the oil inlet 41 flows to an end portion of the exhaust rocker arm 3, and the oil outlet 45 is formed in the adjustor bolt 50 so that the oil is discharged through the adjustor bolt 50.

[0045] The oil flow path 43 has an end connected to a joint of the adjustor bolt 50.

[0046] The oil outlet 45 is formed in an internal space of a bolt shank 51 of the adjustor bolt 50 in an axial direction, and has an inlet communicating with the oil flow path 43 through a circumferential hole of the bolt shank 51 and an outlet connected to the bridge 60.

[0047] FIG. 3 shows a detailed configuration of the bridge 60.

[0048] As shown in FIG. 3, the bridge 60 includes a bridge body 61 in which a chamber is formed by an inner hollow space, a plug 62 that has a plug chamber oil inlet 62-1 into which the oil of the oil supply member 20 flows and a plug chamber 61-1 of the bridge body 61, a pair of first and second master pistons 67-1 and 67-2 which are located at both left and right sides of the bridge body 61 and to which a pressure of the oil flowing from the plug chamber oil inlet 62-1 into the chamber is applied, and a reset pin 69 that is installed on a lower portion of the bridge body 61 so that the oil of the chamber is discharged to the outside.

[0049] The chamber of the bridge body 61 includes the plug chamber 61-1 into which the plug 62 is inserted, a pair of first and second oil diffusion paths 63-1 and 63-2 that extend toward the pair of first and second master pistons 67-1 and 67-2 at left and right sides of the plug chamber 61-1, and a pair of first and second piston chambers 65-1 and 65-2 that are formed in ends of the pair of first and second oil diffusion paths 63-1 and 63-2 so that the pair of first and second master pistons 67-1 and 67-2 are housed therein.

[0050] The plug chamber oil inlet 62-1 of the plug 62 communicates with the plug chamber 61-1.

[0051] In the pair of first and second master pistons 67-1 and 67-2, the first master piston 67-1 presses the first exhaust valve 5-1, and the second master piston 67-2 presses the second exhaust valve 5-2.

[0052] In particular, the first master piston 67-1 and the first exhaust valve 5-1 are formed at a predetermined interval without being in contact with each other, and the second master piston 67-2 and the second exhaust valve 5-2 are formed at a predetermined interval without being in contact with each other. These intervals are the same interval D.

[0053] Therefore, the pair of first and second master pistons 67-1 and 67-2 are pushed to the interval D or more by the oil pressure. Thereby, the pair of first and second master pistons 67-1 and 67-2 press the pair of the first and second exhaust valves 5-1 and 5-2, and forcibly be opens the pushed first and second exhaust valves 5-1 and 5-2.

[0054] The reset pin 69 is configured so that one part thereof is housed in the plug chamber 61-1 of the bridge body 61 and the other part thereof is exposed to the outside of the bridge body 61 and is in contact with the reset bar 80. As such, the reset pin 69 moves to discharge the oil in the inside of the bridge 60 to the outside thereof due to an action of the reset bar 80 at a predetermined point in time.

[0055] FIG. 4 shows a state in which the integrated engine brake according to an exemplary embodiment of the present invention is activated by an oil flow and pressure until the piston reaches a compression top dead center.

[0056] As shown in FIG. 4, when the engine brake lever 10 installed on the steering wheel 7 is switched on, the engine oil flow path 4a of the rocker arm shaft 4 is opened by activation of the valve 30 based on an engine control unit (ECU) 9, and the internal oil flow path 40 of the exhaust rocker arm 3 is supplied with the oil.

[0057] In other words, the oil inlet 41 causes the engine oil to flow into the oil flow path 43, and the oil flowing into the oil flow path 43 flows to the adjustor bolt 50 located on an end of the oil flow path 43 due to the oil pressure.

[0058] Then, the oil flowing through the oil flow path 43 flows into the oil outlet 45 formed in the bolt shank 51 of the adjustor bolt 50, and the oil flowing into the oil outlet 45 flows along the oil outlet 45. Thereby, the oil flowing through the oil outlet 45 flows into the plug chamber oil inlet 62-1 of the plug 62.

[0059] Subsequently, the oil flowing into the plug chamber oil inlet 62-1 is discharged to the plug chamber 61-1. Thereby, the oil pressure is formed in the plug chamber 61-1, and the oil of the plug chamber 61-1 is discharged to the pair of first and second oil diffusion paths 63-1 and 63-2 which are connected to both of the left and right sides of the plug chamber 61-1.

[0060] The oil discharged to the pair of first and second oil diffusion paths 63-1 and 63-2 flows into the pair of first and second piston chambers 65-1 and 65-2 formed on the ends of the respective oil diffusion paths 63-1 and 63-2. Thereby, the oil pressure is formed in the pair of first and second piston chambers 65-1 and 65-2, and the pair of first and second master pistons 67-1 and 67-2 housed in the pair of first and second piston chambers 65-1 and 65-2 move downward by the oil pressure.

[0061] Due to such downward movement of the pair of first and second master pistons 67-1 and 67-2, the interval D formed between the pair of first and second master pistons 67-1 and 67-2 and the pair of first and second exhaust valves 5-1 and 5-2 is decreased. As a result, the first master piston 67-1 comes into contact with the first exhaust valve 5-1, and the second master piston 67-2 comes into contact with the second exhaust valve 5-2. A state in which the interval D is equal to 0(zero) is denoted by an interval D-1.

[0062] Such an operation is realized until the piston reaches the compression top dead center.

[0063] FIG. 5A shows a state in which the pair of first and second exhaust valves 5-1 and 5-2 are forcibly opened.

[0064] As shown in FIG. 5A, when the protrusion 90-1 comes into contact with the exhaust rocker arm roller 93 at the compression top dead center while the exhaust cam 91 rotates, the exhaust rocker arm 3 is lifted by the protrusion 90-1.

[0065] Then, due to the seesaw mechanism, the rocker arm shaft 4 associated with the bridge 60 is lowered using the rocker arm shaft as an axis, and thereby the bridge 60 is pushed.

[0066] Subsequently, the forcible pushing of the bridge 60 acts on the pair of first and second master pistons 67-1 and 67-2 which continue to be in contact with the pair of first and second exhaust valves 5-1 and 5-2 (at the interval D-1), and thereby the pair of first and second master pistons 67-1 and 67-2 are pressed downward.

[0067] As a result, the first exhaust valve 5-1 and the second exhaust valve 5-2 are pushed, and thereby the combustion chamber is switched to a forced open state.

[0068] Thus, in the engine, the compressed air is discharged to the atmosphere at the compression top dead center, and thus does not push down the piston. Thereby, the engine brake realizes the operation of preventing the driving force from being generated.

[0069] FIG. 5B shows a state in which the exhaust cam 91 further rotates after the compression top dead center, and thereby the exhaust rocker arm 3 lifted by the protrusion 90-1 is returned to an original state again, and in which the interval between the pair of first and second master pistons 67-1 and 67-2 and the pair of the first and second exhaust valves 5-1 and 5-2 is returned from the interval D-1 to the interval D ($D \neq 0$) again.

[0070] As shown in FIG. 5C, the reset bar 80 applies a force F to a lower portion of the reset pin 69, and thus the reset pin 69 is pushed into the internal chamber of the bridge 60. Thereby, the oil filled in the internal chamber of the bridge 60 is discharged to the outside. As such, the return state of the interval D ($D \neq 0$) is realized.

[0071] As described above, the integrated engine brake according to the exemplary embodiment of the present invention includes the internal oil flow path 40 through which the oil flowing toward the exhaust rocker arm 3 is supplied to the bridge 60 to form the oil pressure so that the bridge 60 is lowered due to the oil pressure and comes into contact with the pair of first and second exhaust valves 5-1 and 5-2 installed in the combustion chamber. Thereby, the integrated engine brake is reduced in size and weight, and can be easily applied to the commercial vehicle engine which has high horsepower and high torque, which is decreased in size and in which the exhaust regulation and the improvement of fuel efficiency are required, due to a compact configuration resulting from the reduction in weight and size.

[0072] As described above, according to the engine brake of the present invention, the engine brake has the oil flow path in the valve mechanism that controls a combustion stroke cycle on the upper portion of the engine,

and thereby an effect of decreasing size and weight is achieved.

[0073] In addition, according to the engine brake of the present invention, the oil flow path using the valve mechanism is applied to the cam shaft that controls a combustion stroke cycle or the exhaust rocker arm that activates the exhaust valve during the exhaust stroke, and thereby an effect of decreasing size and can be further achieved.

[0074] According to the engine brake of the present invention, the engine brake has a compact configuration resulting from the reduction in weight and size, and is suitable for the commercial vehicle engine for which the exhaust regulation and the improvement of fuel efficiency are required. The engine brake is easily applied to the commercial vehicle engine which has, in particular, high horsepower and high torque while its size is decreased according to requirements for the exhaust regulation and the improvement of fuel efficiency.

[0075] For convenience in explanation and accurate definition in the appended claims, the terms "upper", "lower", "inner" and "outer", are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures.

[0076] The foregoing descriptions of specific exemplary embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teachings. The exemplary embodiments were chosen and described in order to explain certain principles of the invention and their practical application, to thereby enable others skilled in the art to make and utilize various exemplary embodiments of the present invention, as well as various alternatives and modifications thereof. It is intended that the scope of the invention be defined by the Claims appended hereto and their equivalents.

Claims

1. An integrated engine brake assembly, comprising:

a valve that forces oil circulating through an engine to flow to an exhaust rocker arm when an engine brake lever is operated;
a bridge that forms an interval with a pair of first and second exhaust valves installed on a combustion chamber;
an internal oil flow path which supplies the oil flowing toward the exhaust rocker arm to the bridge through an internal space of the exhaust rocker arm, and along which the oil is supplied to the bridge and brings the bridge into contact with the pair of first and second exhaust valves under pressure; and
a protrusion that lifts up the exhaust rocker arm at a compression top dead center so that the pair of first and second exhaust valves are pressed and opened forcibly by the bridge, and the bridge is pressed by seesaw movement of the exhaust rocker arm.

2. The integrated engine brake assembly of claim 1, wherein the internal oil flow path includes:

an oil inlet that is formed in a shaft hole of the exhaust rocker arm and into which the oil that flows toward the exhaust rocker arm flows;
an oil flow path that is formed inside the exhaust rocker arm so that an oil flow of the oil inlet leads to an end portion of the exhaust rocker arm; and
an oil outlet that is connected to the oil flow path so that the oil flowing into the oil flow path is discharged to the bridge.

3. The integrated engine brake assembly of claim 2, wherein the oil outlet is formed in an adjustor bolt, and the adjustor bolt is coupled to the exhaust rocker arm and comes into contact with the bridge.

4. The integrated engine brake assembly of claim 3, wherein the oil outlet is formed in an internal space of the adjustor bolt in an axial direction, and the oil outlet communicates with the oil flow path through a circumferential hole of the adjustor bolt.

5. The integrated engine brake assembly of claim 2, wherein the bridge includes:

a chamber that is filled with the oil discharged from the oil outlet to form oil pressure;
a pair of first and second master pistons that are housed in the chamber to be lowered due to the oil pressure of the chamber and come into contact with the pair of first and second exhaust valves; and
a reset pin, a portion of which is exposed to an outside of the chamber and comes into contact with a reset bar so that the oil within the chamber is discharged to the outside, when the reset pin is activated.

6. The integrated engine brake assembly of claim 5, wherein the chamber includes a plug having a plug chamber oil inlet into which the oil discharged from the oil outlet flows, and which discharges the oil to the chamber.

7. The integrated engine brake assembly of claim 5, wherein the pair of first and second master pistons are housed in the pair of first and second piston chambers in which the oil pressure is formed, and
wherein the pair of first and second piston chambers are connected to a pair of first and second oil diffusion paths which extend toward both of left and right

ends of the chamber.

8. The integrated engine brake assembly of claim 1, wherein the exhaust rocker arm further includes a bias spring, and the bias spring presses the exhaust rocker arm so that the adjustor bolt coupled to the exhaust rocker arm comes into contact with the bridge.

9. The integrated engine brake assembly of claim 1, wherein the protrusion protrudes from an outer circumferential surface of a rotated exhaust cam.

10. The integrated engine brake assembly of claim 9, wherein the protrusion comes into contact with an exhaust rocker arm roller, and the exhaust rocker arm roller is formed on the exhaust rocker arm.

FIG.1A

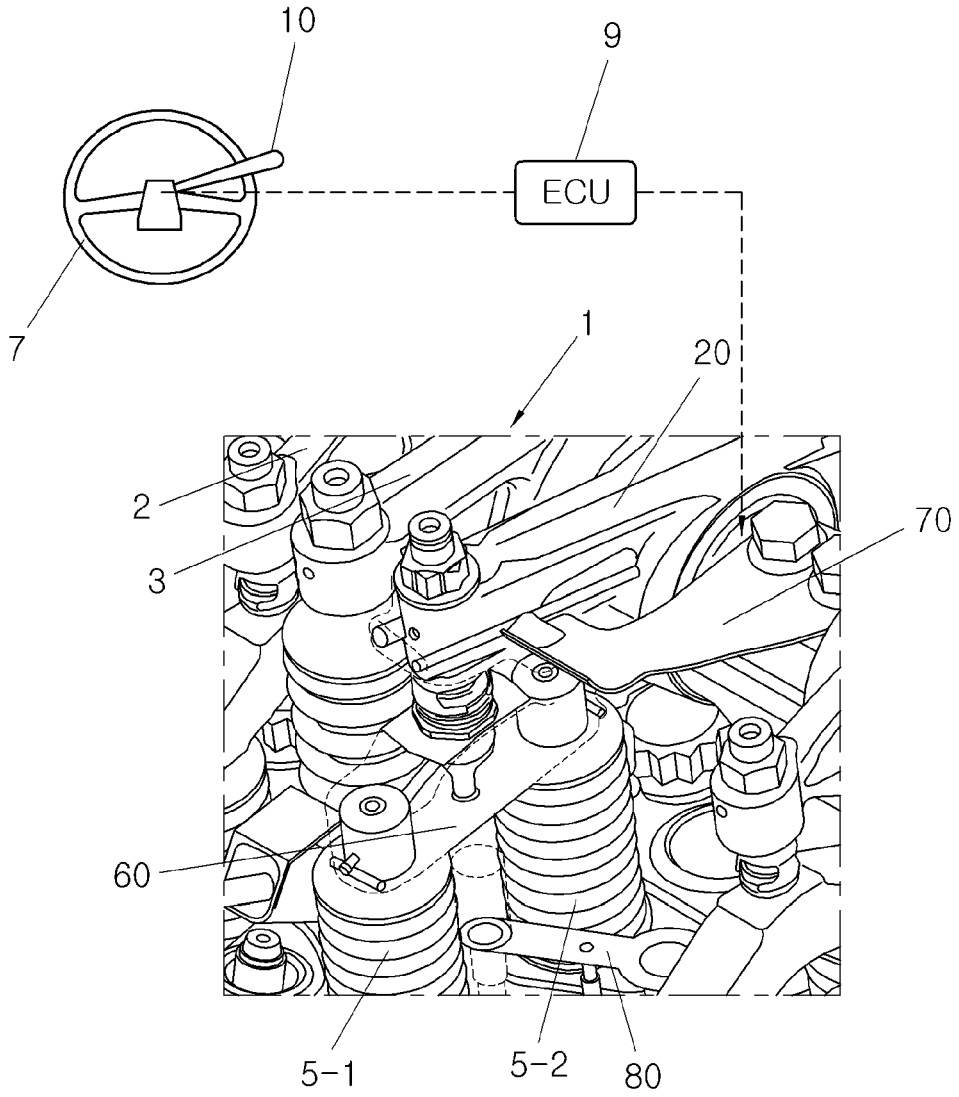


FIG.1B

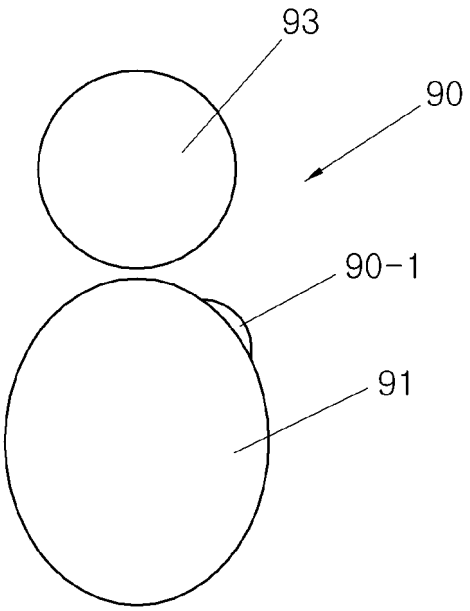


FIG.2

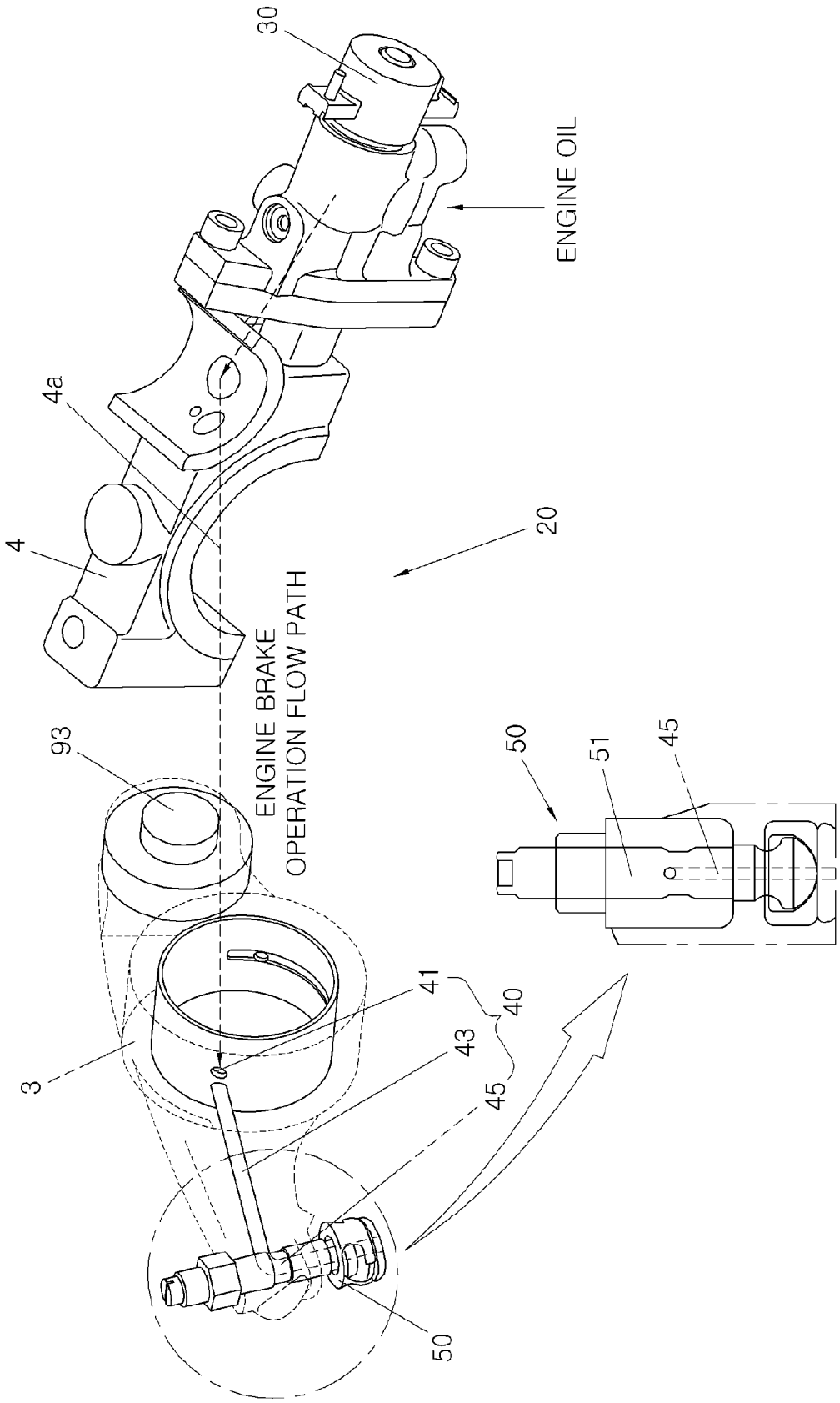
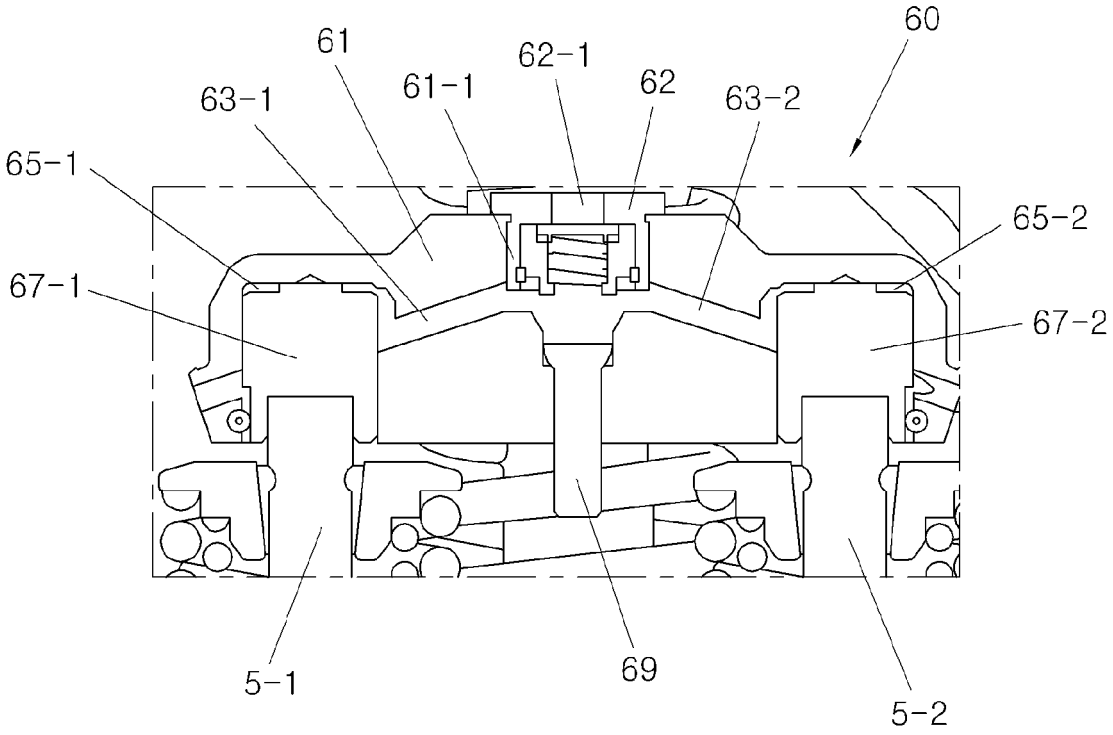

30
ENGINE OIL
4a
4
20
ENGINE BRAKE
OPERATION FLOW PATH
93
50
51
45
41
40
43
45
3
50

FIG.3



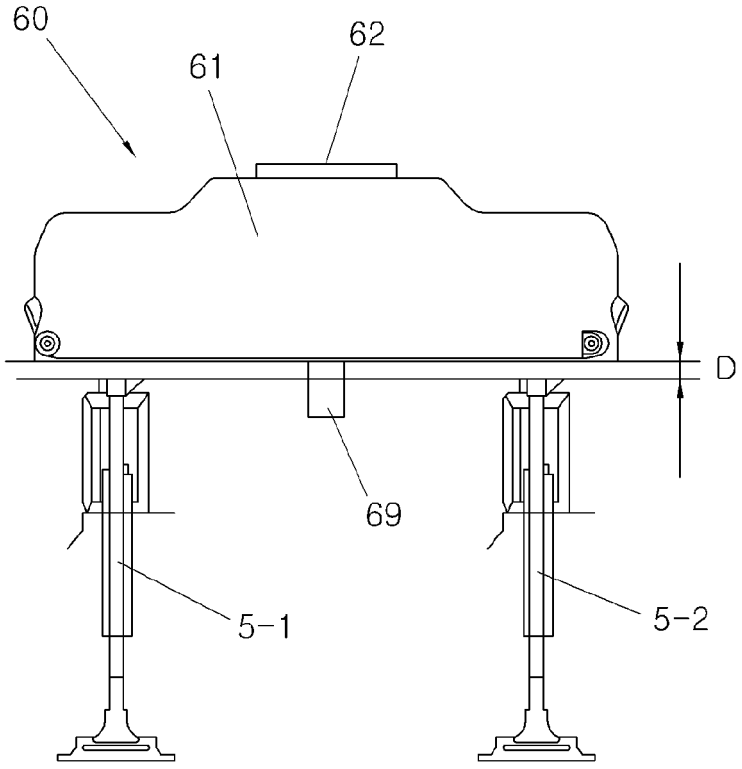
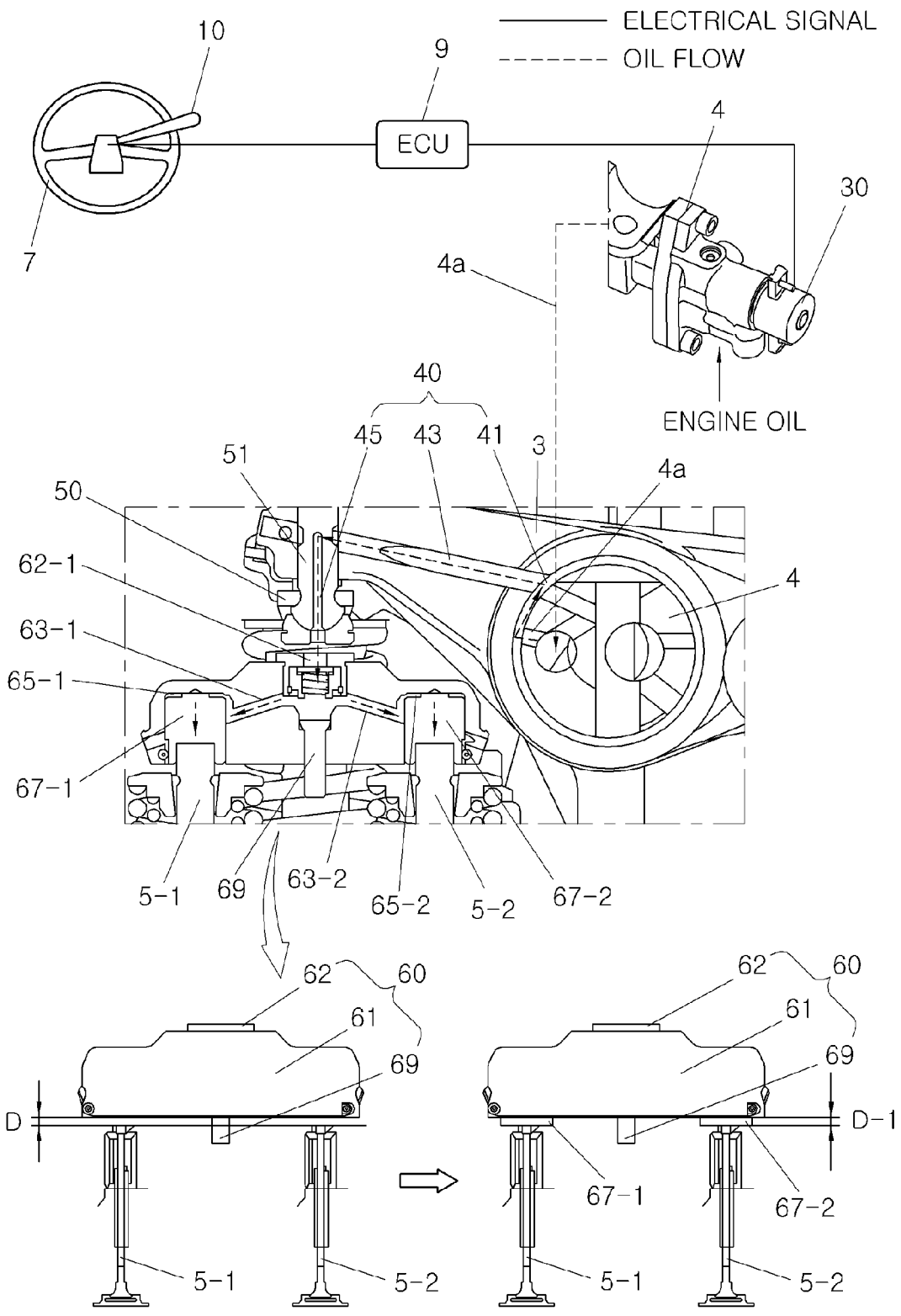


FIG.4


ELECTRICAL SIGNAL
OIL FLOW
10
9
ECU
4
30
7
4a
ENGINE OIL
40
45
43
41
3
51
50
62-1
63-1
65-1
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D-1

FIG.5A

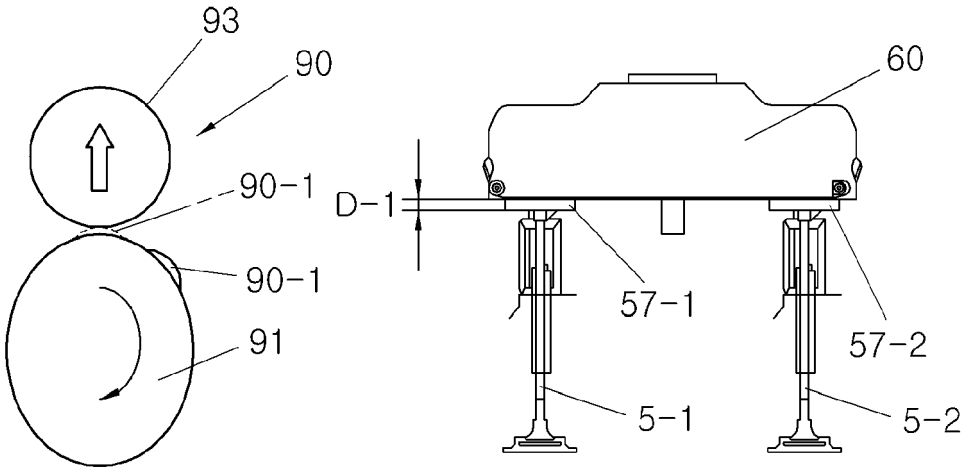


FIG.5B

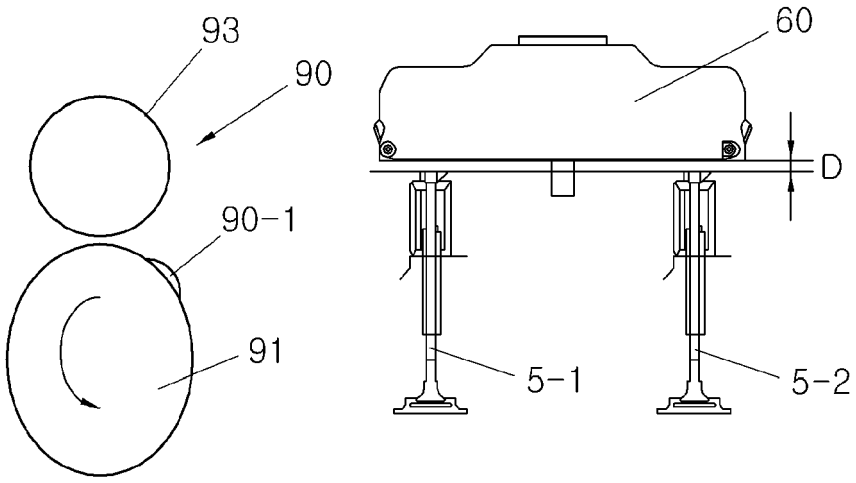
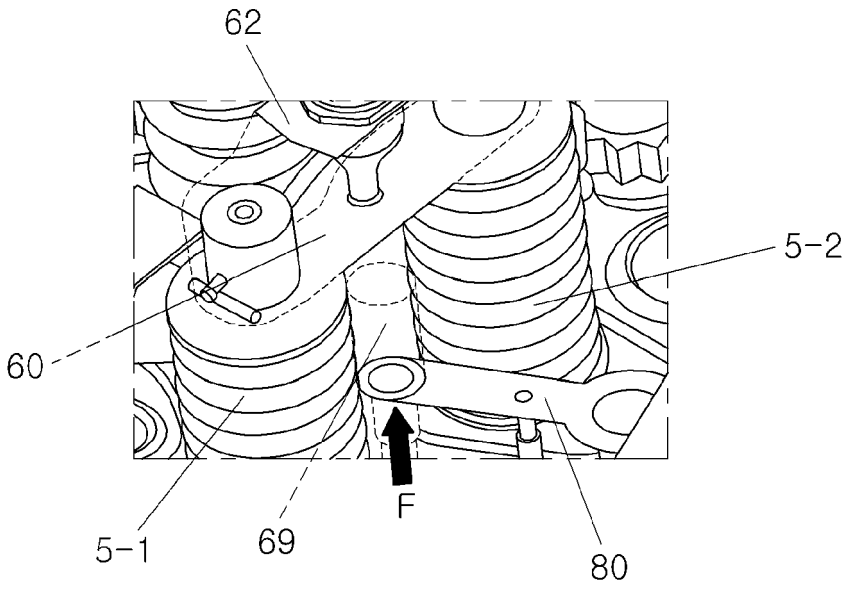


FIG.5C



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EP 13 19 6579

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 439 381 A1 (SHANGHAI UNIVERSOON AUTOPARTS [CN]; YANG ZHOU [US]) 11 April 2012 (2012-04-11) * paragraphs [0086] - [0088]; figures 18A,18B,19,20A,20B *	1-10	INV. F01L13/06 F01L1/26 F02D13/04
Y	US 2010/170471 A1 (YANG ZHOU [US]) 8 July 2010 (2010-07-08) * paragraph [0059]; figures 1-3,6A,6B *	1-10	
Y	DE 10 2006 054312 A1 (HYUNDAI MOTOR CO LTD [KR]) 14 June 2007 (2007-06-14) * the whole document *	1-10	
Y	US 2005/211206 A1 (RUGGIERO BRIAN [US] ET AL) 29 September 2005 (2005-09-29) * paragraphs [0039] - [0042]; figures 1-4 *	10	
E	EP 2 677 127 A1 (XI YONG [CN]) 25 December 2013 (2013-12-25) * figures 10,11 *	1-3	TECHNICAL FIELDS SEARCHED (IPC) F01L F02D
A	WO 2010/141633 A1 (JACOBS VEHICLE SYSTEMS INC [US]; DODI SOTIR [US]; RUGGIERO BRIAN [US]) 9 December 2010 (2010-12-09) * paragraph [0019]; figure 1 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 April 2015	Clot, Pierre

CATEGORY OF CITED DOCUMENTS

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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01-04-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2439381 A1	11-04-2012	EP 2384396 A2	09-11-2011
		EP 2439381 A1	11-04-2012
		EP 2444602 A1	25-04-2012
		KR 20110112390 A	12-10-2011
		RU 2011132887 A	10-02-2013
US 2010170471 A1	08-07-2010	NONE	
DE 102006054312 A1	14-06-2007	CN 1978872 A	13-06-2007
		DE 102006054312 A1	14-06-2007
		JP 5122109 B2	16-01-2013
		JP 2007154872 A	21-06-2007
		KR 20070060403 A	13-06-2007
		US 2007175441 A1	02-08-2007
US 2005211206 A1	29-09-2005	BR PI0508691 A	18-09-2007
		CN 101142380 A	12-03-2008
		CN 102140945 A	03-08-2011
		EP 1733125 A2	20-12-2006
		JP 5085315 B2	28-11-2012
		JP 5256309 B2	07-08-2013
		JP 2007529685 A	25-10-2007
		JP 2011127611 A	30-06-2011
		KR 20070006681 A	11-01-2007
		US 2005211206 A1	29-09-2005
		US 2011132298 A1	09-06-2011
		WO 2005089274 A2	29-09-2005
EP 2677127 A1	25-12-2013	EP 2677127 A1	25-12-2013
		US 2013319370 A1	05-12-2013
		WO 2012109780 A1	23-08-2012
WO 2010141633 A1	09-12-2010	CN 102459830 A	16-05-2012
		EP 2438276 A1	11-04-2012
		JP 2012528985 A	15-11-2012
		KR 20120025555 A	15-03-2012
		US 2010319657 A1	23-12-2010
		WO 2010141633 A1	09-12-2010

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- KR 1020130121171 **[0001]**