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(19) **United States**(12) **Patent Application Publication**
JEON et al.(10) **Pub. No.: US 2012/0048221 A1**(43) **Pub. Date: Mar. 1, 2012**(54) **VARIABLE VALVE ACTUATOR**(52) **U.S. Cl. 123/90.16**(75) **Inventors:** **Jae Hee JEON**, Suwon-si (KR);
Kang Hyeok LEE, Seoul (KR)(57) **ABSTRACT**(73) **Assignees:** **Kia Motors Corporation**, Seoul
(KR); **Hyundai Motor Company**,
Seoul (KR)

A variable valve actuator may include a rocker arm which may be pivotally connected to a rocker shaft, and of which a rocker arm hydraulic pressure supply line and a rocker arm hydraulic pressure exhaust line may be formed therein, a variable control piston which may be fluid-connected to the rocker arm hydraulic pressure supply line and slidably interferes the rocker arm hydraulic pressure exhaust line to selectively close the rocker arm hydraulic pressure exhaust line according to supplying hydraulic pressure of the rocker arm hydraulic pressure supply line, an actuating portion which may be selectively fluid-connected to the rocker arm hydraulic pressure supply line and the rocker arm hydraulic pressure exhaust line by the variable control piston such that the actuating portion selectively protrudes according to the supplying hydraulic pressure of the rocker arm hydraulic pressure supply line, and a valve unit opened according to reciprocation of the actuating portion.

(21) **Appl. No.: 12/949,652**(22) **Filed: Nov. 18, 2010**(30) **Foreign Application Priority Data**

Aug. 31, 2010 (KR) 10-2010-0085148

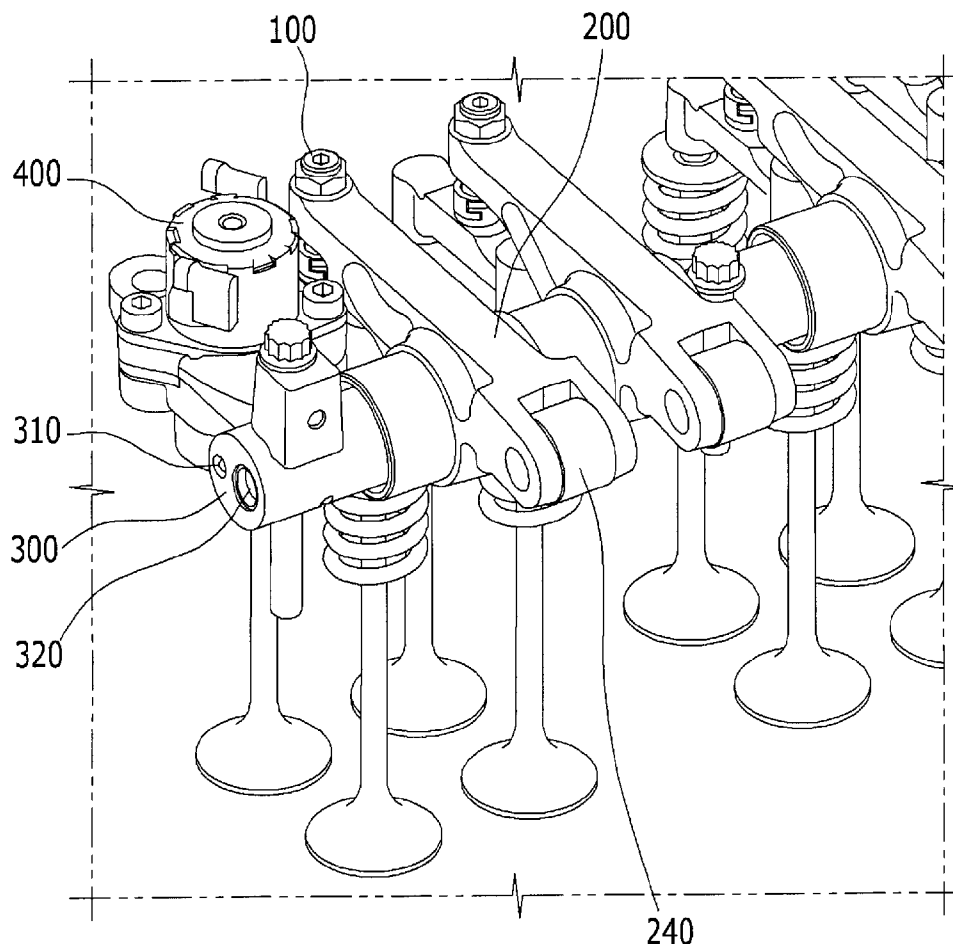
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F01L 1/34 (2006.01)

FIG.1

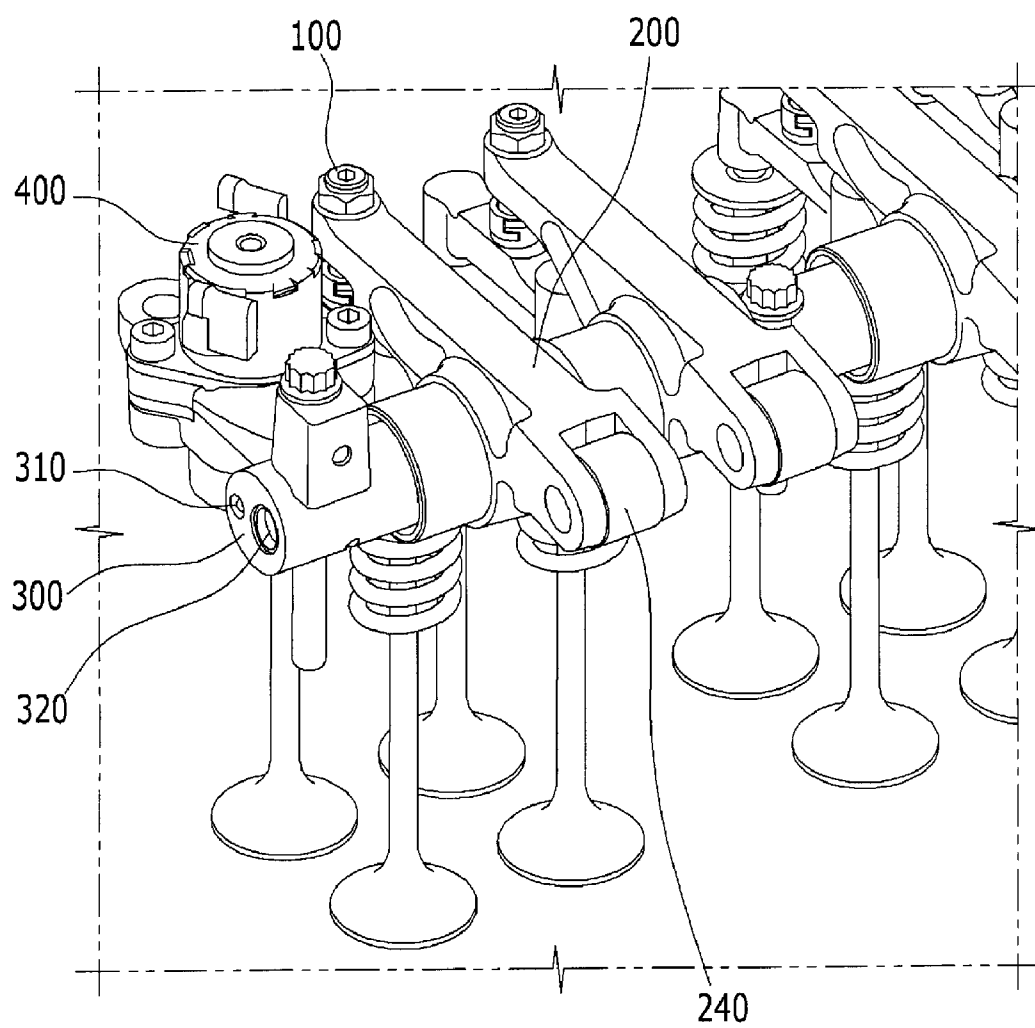


FIG.2

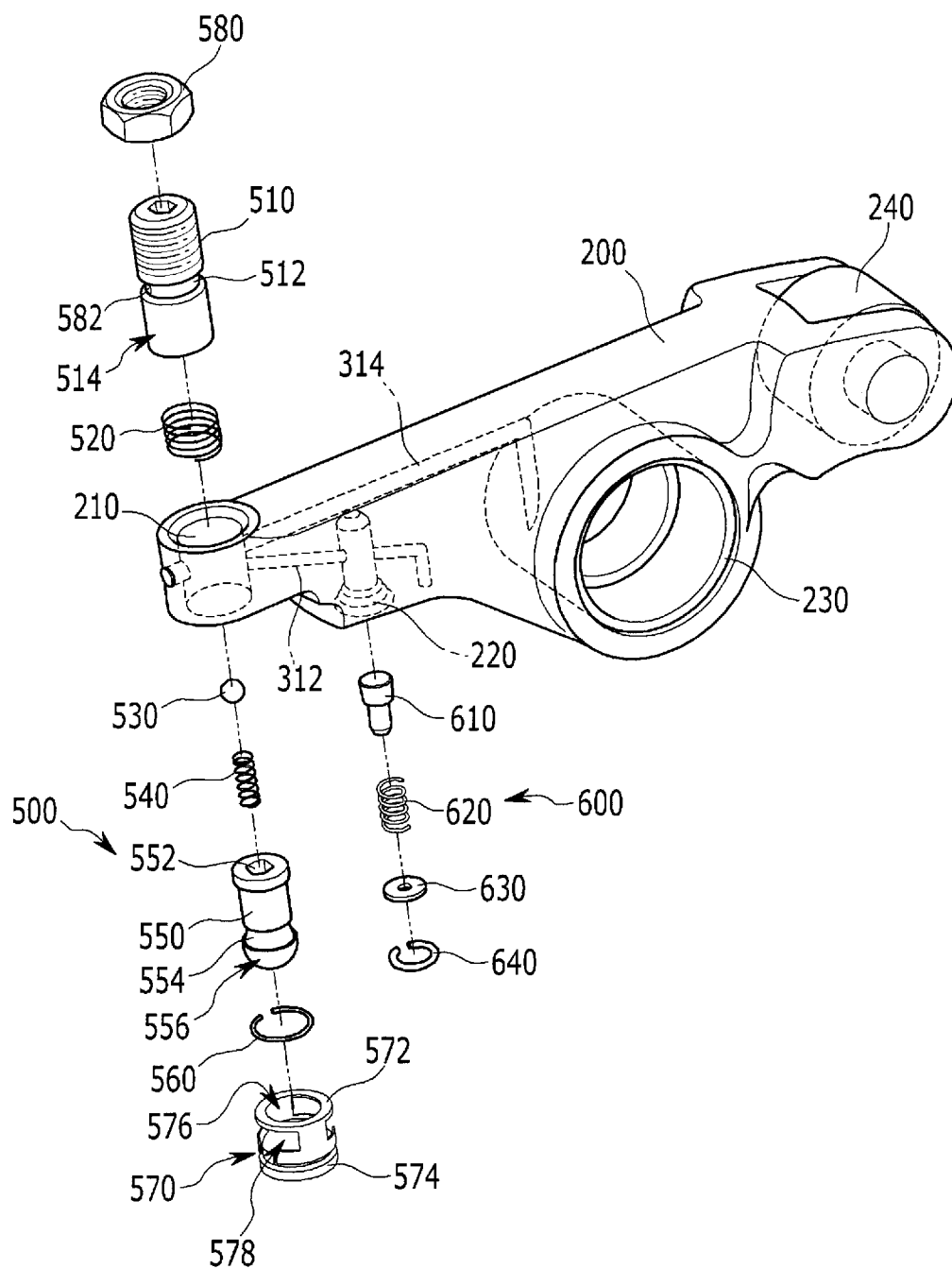


FIG.3

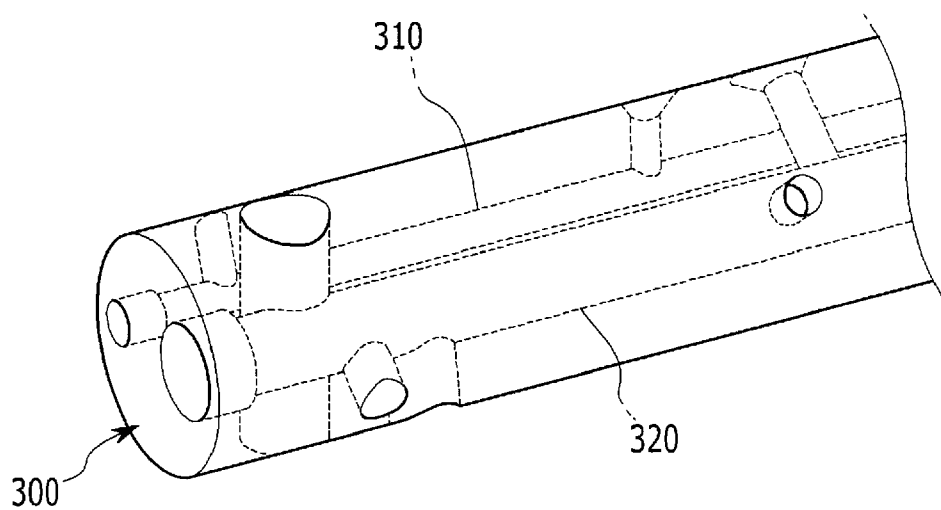


FIG.4

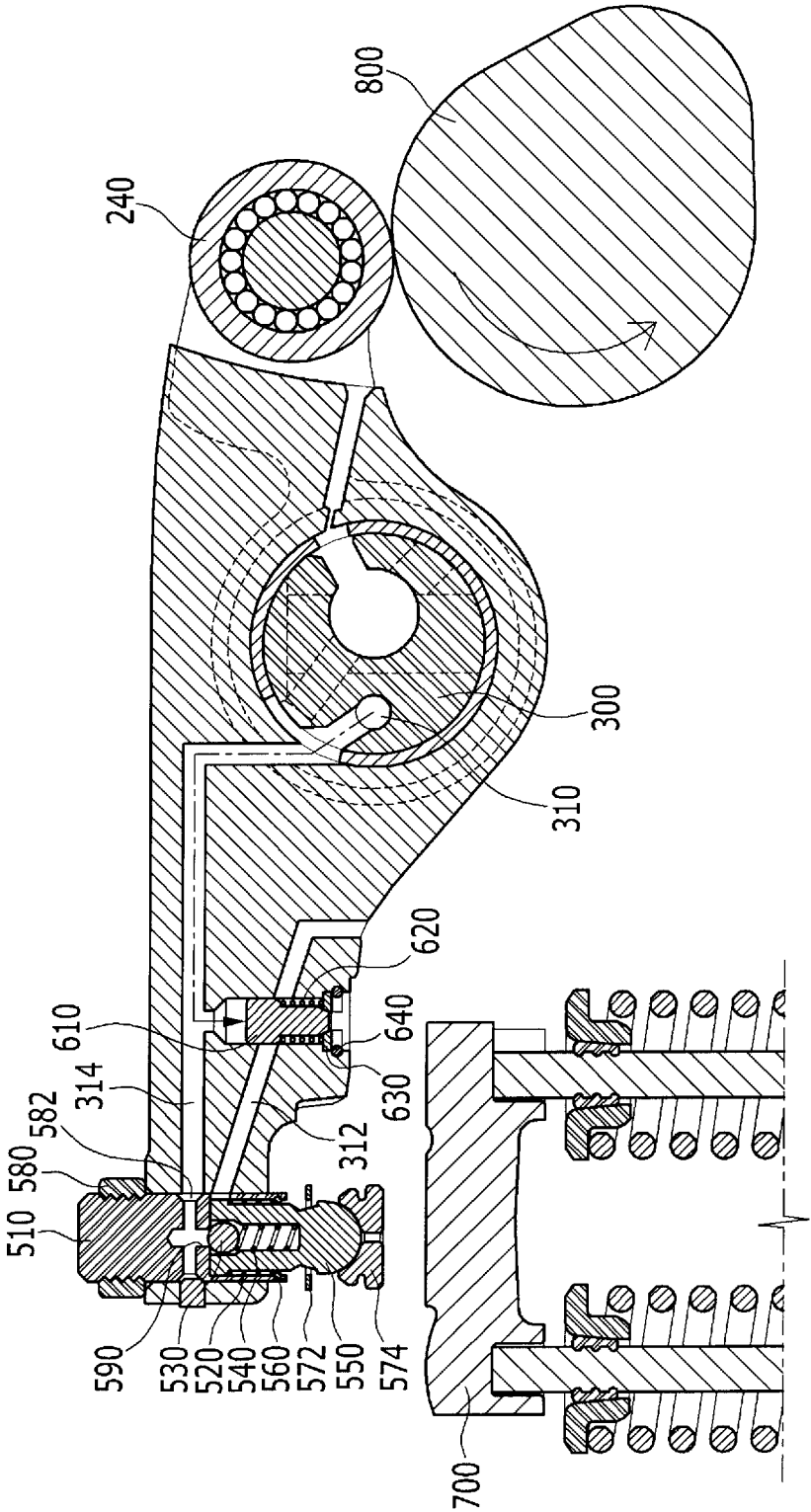


FIG.6

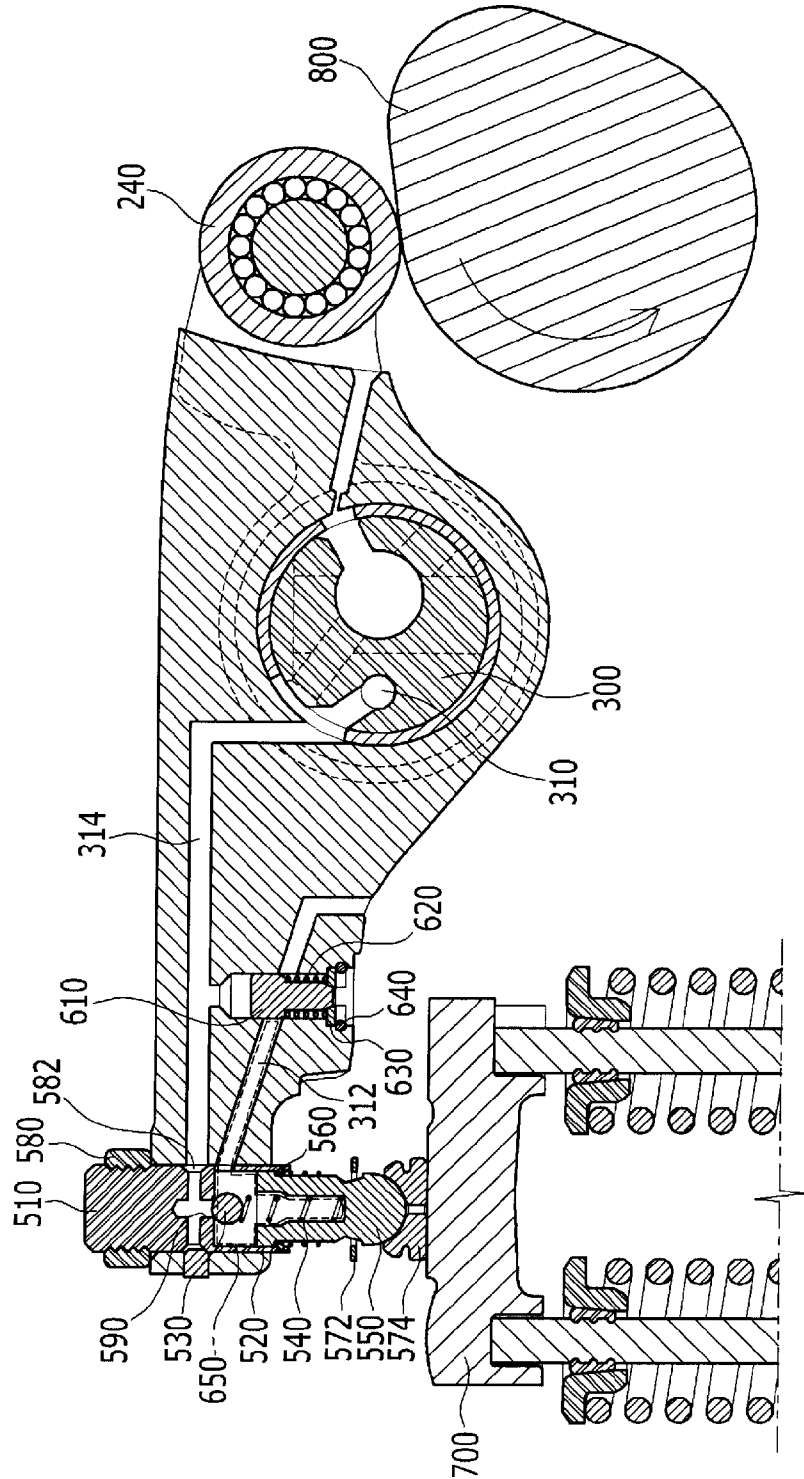


FIG. 7

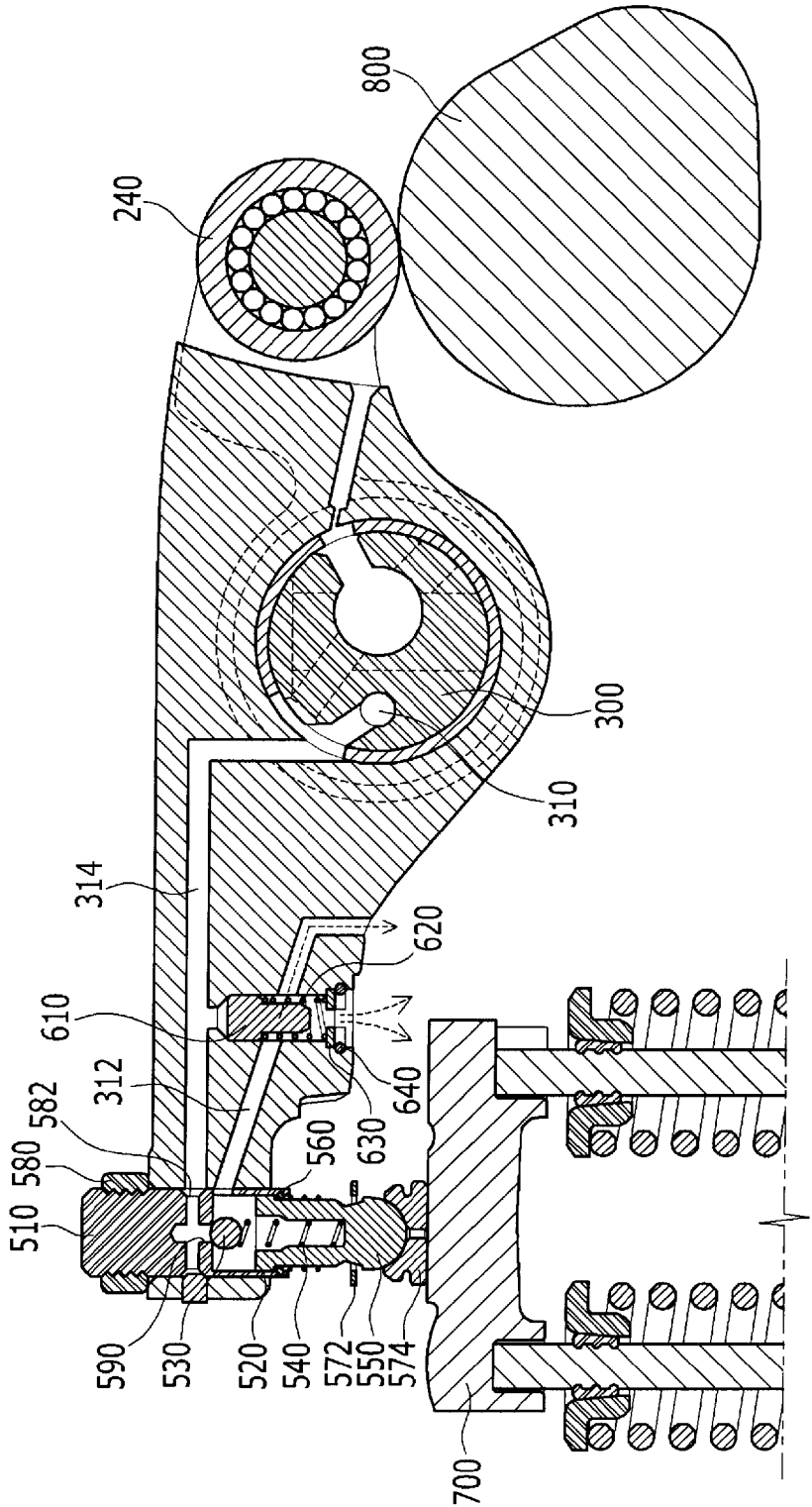


FIG. 8

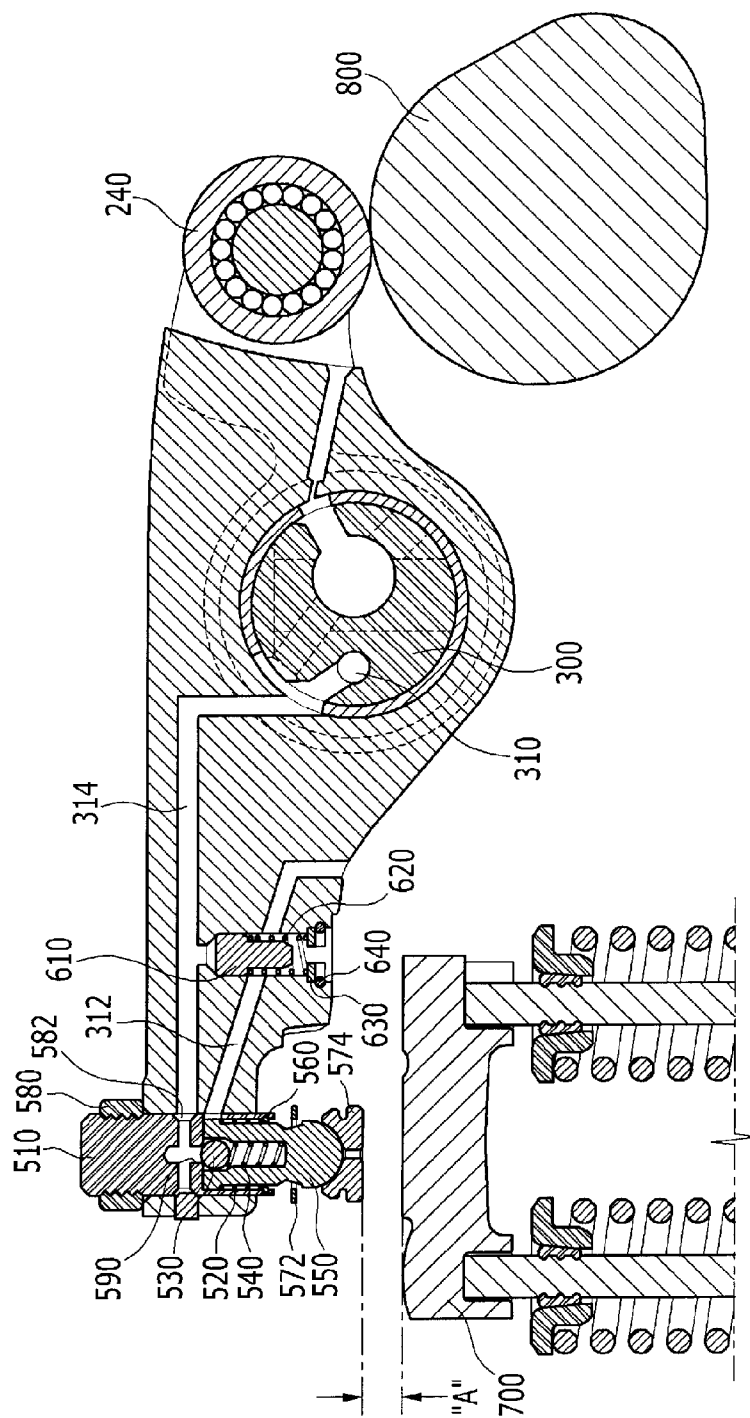


FIG. 9

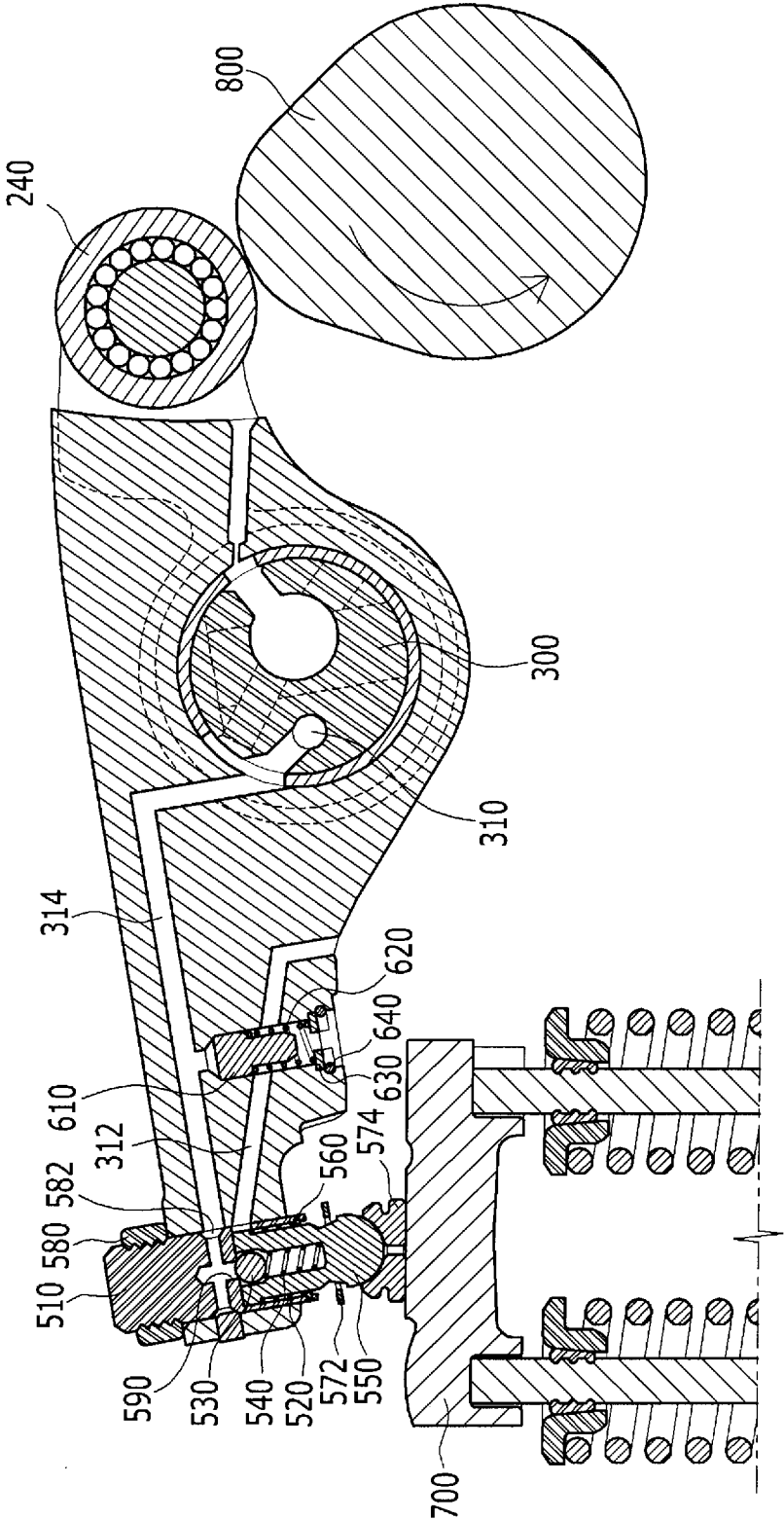
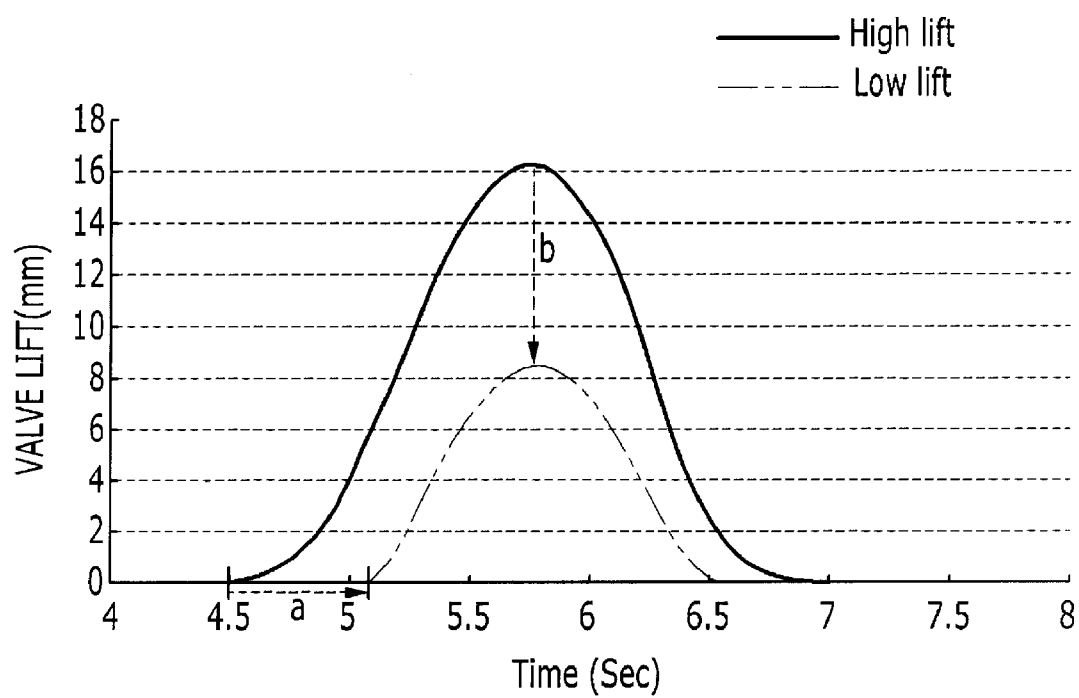


FIG.10



VARIABLE VALVE ACTUATOR

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Korean Patent Application No. 10-2010-0085148 filed in the Korean Intellectual Property Office on Aug. 31, 2010, the entire contents of which is incorporated herein for all purposes by this reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a variable valve actuator. More particularly, the present invention relates to a variable valve actuator of which a variable control portion and an actuating portion, selectively supplying hydraulic pressure so as to vary valve lift according to engine load, are integrally formed to a rocker arm.

[0004] 2. Description of Related Art

[0005] An internal combustion engine generates power by burning fuel in a combustion chamber in air media drawn into the chamber. Intake valves are operated by a camshaft in order to intake the air, and the air is drawn into the combustion chamber while the intake valves are open. In addition, exhaust valves are operated by the camshaft, and a combustion gas is exhausted from the combustion chamber while the exhaust valves are open.

[0006] An optimal operation of the intake valves and the exhaust valves depends on a rotation speed of the engine. That is, an optimal lift or optimal opening/closing timing of the valves depends on the rotation speed of the engine. In order to achieve such an optimal valve operation depending on the rotation speed of the engine, various research has been undertaken. For example, research has been undertaken for a variable valve lift (variable valve lift; VVL) that enables different lifts depending on an engine speed.

[0007] In a conventional art, an ADD-ON type of a hydraulic pressure variable valve control apparatus has been used.

[0008] In the ADD-ON type of a hydraulic pressure variable valve control apparatus, an actuator piston and a control valve is disposed to a housing.

[0009] Since the control valve and a check ball is disposed within one body, weight of the apparatus is relatively large, and since the actuator piston connected to a screw, so that size of a piston chamber also relatively large and heavy.

[0010] Since a closed circuit where pressure is formed is relatively large, response of a system may be delayed and thus engine performance may be deteriorated.

[0011] 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 OF THE INVENTION

[0012] Various aspects of the present invention are directed to provide a variable valve actuator of which a variable control portion and an actuating portion, selectively supplying hydraulic pressure so as to vary valve lift according to engine load, are integrally formed to a rocker arm, and the variable valve actuator which may enhance response of a system.

[0013] In an aspect of the present invention, the variable valve actuator may include a rocker arm which may be pivotally connected to a rocker shaft, and of which a rocker arm hydraulic pressure supply line and a rocker arm hydraulic pressure exhaust line may be formed therein, wherein an actuating portion may include a screw which may be disposed at an end of the rocker arm, fluid-connected to the rocker arm hydraulic pressure supply line for being selectively supplied hydraulic pressure therefrom, and fluid-connected to the rocker arm hydraulic pressure exhaust line for exhausting the hydraulic pressure thereto, an actuator piston which may be slidably disposed within the screw and selectively moves up and down according to the hydraulic pressure supplied to the screw through the rocker arm hydraulic pressure supply line, a check ball which may be disposed between the rocker arm hydraulic pressure supply line and the rocker arm hydraulic pressure exhaust line for selectively supplying the hydraulic pressure from the rocker arm hydraulic pressure supply line into the actuator piston, and an actuator spring elastically supporting the check ball toward the rocker arm hydraulic pressure supply line in the actuator piston, wherein a variable control portion may include a variable control piston which may be fluid-connected to the rocker arm hydraulic pressure supply line and slidably interferes the rocker arm hydraulic pressure exhaust line, and selectively closes the rocker arm hydraulic pressure exhaust line according to the hydraulic pressure of the rocker arm hydraulic pressure supply line supplied to an end thereof, and a variable control spring elastically biasing the variable control piston to open the rocker arm hydraulic pressure exhaust line, and wherein a valve unit may be opened by the actuator piston in accordance with pivoting motion of the rocker arm.

[0014] The actuating portion further may include a return spring elastically biasing the actuator piston toward the rocker arm hydraulic pressure supply line, and a first snap ring formed between the screw and the actuator piston for supporting the return spring not to be disconnected from the screw.

[0015] The actuating portion further may include a socket ball assembly of which an opening portion may be formed thereto for the actuator piston to be pivotally connected thereto, wherein the socket ball assembly may include a retainer of which the opening portion may be formed at upper portion thereof and a cutting portion may be formed at a lateral side thereof to slidably receive a piston lower portion of the actuator piston, and a socket ball which may be connected to the retainer and contacts the valve unit.

[0016] The variable control portion further may include a plate supporting the variable control spring at a lower portion thereof, and a second snap ring supporting the plate.

[0017] The variable valve actuator further may include a solenoid valve which controls supplying hydraulic pressure of the rocker arm hydraulic pressure supply line.

[0018] The variable valve actuator further may include an actuating portion insert hole formed to the end of the rocker arm and a variable control portion insertion hole formed beside the actuating portion insert hole, and wherein the actuating portion may be inserted into the actuating portion insert hole and the variable control portion may be inserted into the variable control portion insertion hole.

[0019] In another aspect of the present invention, the variable valve actuator may include a rocker arm which may be pivotally connected to a rocker shaft, and of which a rocker arm hydraulic pressure supply line and a rocker arm hydraulic

pressure exhaust line may be formed therein, a variable control piston which may be fluid-connected to the rocker arm hydraulic pressure supply line and slidably interferes the rocker arm hydraulic pressure exhaust line to selectively close the rocker arm hydraulic pressure exhaust line according to supplying hydraulic pressure of the rocker arm hydraulic pressure supply line, an actuating portion which may be selectively fluid-connected to the rocker arm hydraulic pressure supply line and the rocker arm hydraulic pressure exhaust line by the variable control piston such that the actuating portion selectively protrudes according to the supplying hydraulic pressure of the rocker arm hydraulic pressure supply line, and a valve unit opened according to reciprocation of the actuating portion, wherein the variable valve actuator further may include an actuating portion insert hole formed to an end of the rocker arm and a variable control portion insertion hole formed beside the actuating portion insert hole, wherein the actuating portion may be inserted into the actuating portion insert hole and the variable control portion may be inserted into the variable control portion insertion hole.

[0020] The actuating portion may include a screw connected to the actuating portion insert hole and being selectively supplied supplying hydraulic pressure from the rocker arm hydraulic pressure supply line, an actuator piston which may be slidably disposed within the screw and selectively moves up and down according to the supplying hydraulic pressure supplied to the screw from the rocker arm hydraulic pressure supply line, a check ball which may be disposed between the rocker arm hydraulic pressure supply line and the rocker arm hydraulic pressure exhaust line for selectively supplying the supplying hydraulic pressure from the rocker arm hydraulic pressure supply line into the actuator piston, and an actuator spring elastically supporting the check ball toward the rocker arm hydraulic pressure supply line.

[0021] The actuating portion may include a return spring elastically supporting the actuator piston toward the rocker arm hydraulic pressure supply line, and a first snap ring which may be inserted between the screw and the actuator piston for preventing disconnection of the actuator piston and the return spring.

[0022] The actuating portion further may include a socket ball assembly of which an opening portion may be formed thereto for the actuator piston to be pivotally connected thereto, wherein the socket ball assembly may include a retainer of which the opening portion may be formed at an upper portion thereof to receive a piston lower portion therein and a cutting portion may be formed at a lateral side thereof, and a socket ball which may be connected to the retainer and slidably contacts the valve unit.

[0023] The variable control portion further may include a plate supporting the variable control spring to open the rocker arm hydraulic pressure exhaust line, and a second snap ring supporting the plate.

[0024] The variable valve actuator further may include a solenoid valve which controls the supplying hydraulic pressure of the rocker arm hydraulic pressure supply line.

[0025] As described above, a variable valve actuator according to an exemplary embodiment of the present invention may include a variable control portion and an actuating portion, selectively supplying hydraulic pressure so as to vary valve lift according to engine load, are integrally formed to a rocker arm, and the variable valve actuator which may enhance response of a system with simple scheme.

[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 of the Invention, which together serve to explain certain principles of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. 1 is a perspective view of a variable valve actuator according to an exemplary embodiment of the present invention.

[0028] FIG. 2 is an exploded perspective view of a variable valve actuator according to an exemplary embodiment of the present invention.

[0029] FIG. 3 is a drawing of a rocker shaft of a variable valve actuator according to an exemplary embodiment of the present invention.

[0030] FIG. 4 to FIG. 6 are drawings showing driving mode change from low lift mode to high lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0031] FIG. 7 to FIG. 9 are drawings showing driving mode change from high lift mode to low lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0032] FIG. 10 is a graph of valve lift showing driving mode change from high lift mode to low lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0033] 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.

[0034] 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 OF THE INVENTION

[0035] 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 understood that 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.

[0036] Exemplary embodiments of the present invention will hereinafter be described in detail with reference to the accompanying drawings.

[0037] FIG. 1 is a perspective view of a variable valve actuator according to an exemplary embodiment of the present invention, FIG. 2 is an exploded perspective view of a variable valve actuator according to an exemplary embodiment of the present invention, and FIG. 3 is a drawing of a rocker shaft of a variable valve actuator according to an

exemplary embodiment of the present invention. FIG. 4 to FIG. 6 are drawings showing driving mode change from low lift mode to high lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0038] FIG. 7 to FIG. 9 are drawings showing driving mode change from high lift mode to low lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0039] FIG. 10 is a graph of valve lift showing driving mode change from high lift mode to low lift change of a variable valve actuator according to an exemplary embodiment of the present invention.

[0040] Although in FIG. 1, a variable valve actuator according to an exemplary embodiment of the present invention is provided to exhaust valve system, however, the variable valve actuator may be provided to intake valve system.

[0041] In operation of supplying hydraulic pressure, the hydraulic pressure is supplied to a rocker arm hydraulic pressure supply line and a rocker arm hydraulic pressure exhaust line 314 and 312 through a supply line 320 for engine lubrication, a solenoid valve 400, and an actuating portion hydraulic pressure supply line 310 of a rocker shaft 300. And then the hydraulic pressure is exhausted through an actuator piston 550.

[0042] Referring to FIG. 2 and FIG. 3, the variable valve actuator includes the rocker shaft 300 of which the supply line 320 for engine lubrication and the actuating portion hydraulic pressure supply line 310 are formed therewithin, an actuating portion 500 which is hingedly connected to the rocker shaft 300, and a valve unit 700 which is opened by the actuating portion 500.

[0043] A variable control portion 600 is disposed between the actuating portion 500 and the rocker shaft 300, and controls valve lift by cooperates with the actuating portion 500.

[0044] The actuating portion 500 includes a screw 510 which is disposed an end of the rocker arm 200, connected to the rocker arm hydraulic pressure supply line 314 through an oil inlet 582, and formed as a cylinder, the actuator piston 550 which is inserted into the screw 510 and elastically supported by a return spring 520, and a first snap ring 560 supporting the return spring 520 not to be disconnected.

[0045] A screw lower portion 514, formed under portion of the screw 510, is hollow, an oil inlet 582 is formed a side of the screw 510 for communicating with the rocker arm hydraulic pressure supply line 314, and a screw groove 512 is formed along circumference of the screw 514.

[0046] The actuating portion 500 further includes the actuator piston 550 which is inserted into the screw lower portion 514 and receives hydraulic pressure through the screw 510, an actuator spring 540 which is inserted into a spring insertion hole 552 formed within the actuator piston 550, a check ball 530 which is elastically supported by the actuator spring 540 and controls for hydraulic pressure to flow through an oil outlet 590 of the screw 510 into the spring insertion hole 552, and a socket ball connecting portion 570 which is pivotally connected to a piston lower portion 556 of the actuator piston 550.

[0047] The piston lower portion 556 of the actuator piston 550 is shaped as a sphere and a piston groove 554 is formed thereto for being connected with the socket ball connecting portion 570.

[0048] The socket ball connecting portion 570 includes a retainer 572 and a socket ball 574. An opening portion 576 is

formed to upper side of the retainer 572 and a cutting portion 578 is formed to a side of the retainer 572. The piston lower portion 556 of the actuator piston 550 is inserted through the opening portion 576 and the opening portion 576 hooks around the piston groove 554.

[0049] And thus, the actuator piston 550 is pivotally connected with the socket ball connecting portion 570. The actuating portion 500 is inserted into actuating portion insert hole 210 formed at an end of the rocker arm 200. A nut 580 may be used for mounting the screw 510.

[0050] The variable control portion 600 includes a variable control piston 610 which selectively closes the rocker arm hydraulic pressure exhaust line 312 according to supplying hydraulic pressure from the rocker arm hydraulic pressure supply line 314, a variable control spring 620 elastically supporting the variable control piston 610, a plate 630 which supports the variable control spring 620 and hole is formed thereto, and a second snap ring 640 for supporting the plate 630.

[0051] The variable control portion 600 is inserted into a variable control portion insertion hole 220 formed beside of the actuating portion insert hole 210.

[0052] Hereinafter, referring to FIG. 4 to FIG. 9, operations of the variable valve actuator according to the exemplary embodiment of the present invention will be described.

[0053] In high lift mode, the solenoid valve 400 is controlled to switch-on to supply hydraulic pressure.

[0054] As shown in FIG. 4, the rocker arm hydraulic pressure supply line 314 is supplied hydraulic pressure through the actuating portion hydraulic pressure supply line 310 formed within the rocker shaft 300.

[0055] And thus, as shown in FIG. 4, the variable control piston 610 moves downward due to hydraulic pressure supplied from the rocker arm hydraulic pressure supply line 314.

[0056] And simultaneously, as shown in FIG. 5, hydraulic pressure is supplied to the screw 510 through the oil inlet 582.

[0057] The check ball 530 of the screw 510 opens the oil outlet 590 and then hydraulic pressure is supplied for the actuator piston 550 to move downward.

[0058] And then the rocker arm hydraulic pressure exhaust line 312, which is closed by the variable control piston, is filled with the hydraulic pressure.

[0059] Finally, the pressure within the actuator piston 550 and the pressure within the rocker arm hydraulic pressure exhaust line 312 become equal, and the check ball 530 moves upward by the restoring force of the actuator spring 540.

[0060] As shown in FIG. 6, the actuator piston 550 and the rocker arm hydraulic pressure exhaust line 312 form an oil closed circuit 650.

[0061] The oil closed circuit 650 is formed by closing the oil outlet 590 with the check ball 530, and simultaneously, by closing the rocker arm hydraulic pressure exhaust line 312 with the variable control piston 610.

[0062] That is, the oil closed circuit 650 is defined as a volume closed by the actuator piston 550 and the rocker arm hydraulic pressure exhaust line 312.

[0063] As described above, when the oil closed circuit 650 is formed, the rocker arm 200 pivots due to rotation of the driving cam 800, and pushes the valve unit 700.

[0064] And thus, the high lift mode is realized.

[0065] When driving mode is changed from the high lift mode to the low lift mode, supplying oil is controlled as shown in FIG. 7 to FIG. 9.

[0066] The solenoid valve 400 is controlled to be off.

[0067] As shown in FIG. 7, the hydraulic pressure forms the oil closed circuit 650 in the high lift mode is released.

[0068] The variable control piston 610 moves upward by restoring force of the variable control spring 620 and the hydraulic pressure is released so as that the oil closed circuit 650 is released.

[0069] The oil is released through lower portion of the plate 630, sides of the variable control portion insertion hole 220 or the rocker arm hydraulic pressure exhaust line.

[0070] After exhausting of the oil, as shown in FIG. 8, the actuator piston 550 moves upward by restoring force of the return spring 520, and control displacement "A" is formed.

[0071] After forming the control displacement "A", the socket ball connecting portion 570 pushes the valve unit 700 by rotation of the driving cam 800, and thus the low lift mode is realized.

[0072] Since the actuator piston 550 is pivotally connected to the socket ball connecting portion 570, the socket ball connecting portion 570 pushes the valve unit 700 without interrupting.

[0073] As described above, the variable valve actuator according to the exemplary embodiment of the present invention may form small volume of the oil closed circuit 650, and thus response speed of the system may be increased and variable control performance may also be improved.

[0074] FIG. 10 is a graph of valve lift showing driving mode change from high lift mode to low lift change of a variable valve actuator according to an exemplary embodiment of the present invention. As shown in FIG. 10, valve lift and valve timing may be simultaneously changed.

[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.

What is claimed is:

1. A variable valve actuator comprising:

a rocker arm which is pivotally connected to a rocker shaft, and of which a rocker arm hydraulic pressure supply line and a rocker arm hydraulic pressure exhaust line are formed therein,

wherein an actuating portion comprises:

a screw which is disposed at an end of the rocker arm, fluid-connected to the rocker arm hydraulic pressure supply line for being selectively supplied hydraulic pressure therefrom, and fluid-connected to the rocker arm hydraulic pressure exhaust line for exhausting the hydraulic pressure thereto;

an actuator piston which is slidably disposed within the screw and selectively moves up and down according

to the hydraulic pressure supplied to the screw through the rocker arm hydraulic pressure supply line;

a check ball which is disposed between the rocker arm hydraulic pressure supply line and the rocker arm hydraulic pressure exhaust line for selectively supplying the hydraulic pressure from the rocker arm hydraulic pressure supply line into the actuator piston; and

an actuator spring elastically supporting the check ball toward the rocker arm hydraulic pressure supply line in the actuator piston;

wherein a variable control portion comprises:

a variable control piston which is fluid-connected to the rocker arm hydraulic pressure supply line and slidably interferes the rocker arm hydraulic pressure exhaust line, and selectively closes the rocker arm hydraulic pressure exhaust line according to the hydraulic pressure of the rocker arm hydraulic pressure supply line supplied to an end thereof; and

a variable control spring elastically biasing the variable control piston to open the rocker arm hydraulic pressure exhaust line; and

wherein a valve unit is opened by the actuator piston in accordance with pivoting motion of the rocker arm.

2. The variable valve actuator of claim 1, wherein the actuating portion further comprises:

a return spring elastically biasing the actuator piston toward the rocker arm hydraulic pressure supply line; and

a first snap ring formed between the screw and the actuator piston for supporting the return spring not to be disconnected from the screw.

3. The variable valve actuator of claim 1, wherein the actuating portion further comprises a socket ball assembly of which an opening portion is formed thereto for the actuator piston to be pivotally connected thereto.

4. The variable valve actuator of claim 3, wherein the socket ball assembly comprises:

a retainer of which the opening portion is formed at upper portion thereof and a cutting portion is formed at a lateral side thereof to slidably receive a piston lower portion of the actuator piston; and

a socket ball which is connected to the retainer and contacts the valve unit.

5. The variable valve actuator of claim 1, wherein the variable control portion further comprises:

a plate supporting the variable control spring at a lower portion thereof; and

a second snap ring supporting the plate.

6. The variable valve actuator of claim 1, wherein the variable valve actuator further comprises a solenoid valve which controls supplying hydraulic pressure of the rocker arm hydraulic pressure supply line.

7. The variable valve actuator of claim 1, wherein the variable valve actuator further comprises an actuating portion insert hole formed to the end of the rocker arm and a variable control portion insertion hole formed beside the actuating portion insert hole, and

wherein the actuating portion is inserted into the actuating portion insert hole and the variable control portion is inserted into the variable control portion insertion hole.

- 8.** A variable valve actuator comprising:
 a rocker arm which is pivotally connected to a rocker shaft,
 and of which a rocker arm hydraulic pressure supply line
 and a rocker arm hydraulic pressure exhaust line are
 formed therein;
 a variable control piston which is fluid-connected to the
 rocker arm hydraulic pressure supply line and slidably
 interferes the rocker arm hydraulic pressure exhaust line
 to selectively close the rocker arm hydraulic pressure
 exhaust line according to supplying hydraulic pressure
 of the rocker arm hydraulic pressure supply line;
 an actuating portion which is selectively fluid-connected to
 the rocker arm hydraulic pressure supply line and the
 rocker arm hydraulic pressure exhaust line by the vari-
 able control piston such that the actuating portion selec-
 tively protrudes according to the supplying hydraulic
 pressure of the rocker arm hydraulic pressure supply
 line; and
 a valve unit opened according to reciprocation of the actu-
 ating portion.
- 9.** The variable valve actuator of claim **8**, wherein the
 variable valve actuator further comprises an actuating portion
 insert hole formed to an end of the rocker arm and a variable
 control portion insertion hole formed beside the actuating
 portion insert hole,
 wherein the actuating portion is inserted into the actuating
 portion insert hole and the variable control portion is
 inserted into the variable control portion insertion hole.
- 10.** The variable valve actuator of claim **9**, wherein the
 actuating portion comprises:
 a screw connected to the actuating portion insert hole and
 being selectively supplied supplying hydraulic pressure
 from the rocker arm hydraulic pressure supply line;
 an actuator piston which is slidably disposed within the
 screw and selectively moves up and down according to
 the supplying hydraulic pressure supplied to the screw
 from the rocker arm hydraulic pressure supply line;
 a check ball which is disposed between the rocker arm
 hydraulic pressure supply line and the rocker arm
 hydraulic pressure exhaust line for selectively supplying
 the supplying hydraulic pressure from the rocker arm
 hydraulic pressure supply line into the actuator piston;
 and
 an actuator spring elastically supporting the check ball
 toward the rocker arm hydraulic pressure supply line.
- 11.** The variable valve actuator of claim **10**, wherein the
 actuating portion comprises:
 a return spring elastically supporting the actuator piston
 toward the rocker arm hydraulic pressure supply line;
 and
 a first snap ring which is inserted between the screw and the
 actuator piston for preventing disconnection of the
 actuator piston and the return spring.
- 12.** The variable valve actuator of claim **11**, wherein the
 actuating portion further comprises a socket ball assembly of
 which an opening portion is formed thereto for the actuator
 piston to be pivotally connected thereto.
- 13.** The variable valve actuator of claim **12**, wherein the
 socket ball assembly comprises:
 a retainer of which the opening portion is formed at an
 upper portion thereof to receive a piston lower portion
 therein and a cutting portion is formed at a lateral side
 thereof; and
 a socket ball which is connected to the retainer and slidably
 contacts the valve unit.
- 14.** The variable valve actuator of claim **9**, wherein the
 variable control portion further comprises:
 a plate supporting the variable control spring to open the
 rocker arm hydraulic pressure exhaust line; and
 a second snap ring supporting the plate.
- 15.** The variable valve actuator of claim **8**, wherein the
 variable valve actuator further comprises a solenoid valve
 which controls the supplying hydraulic pressure of the rocker
 arm hydraulic pressure supply line.

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