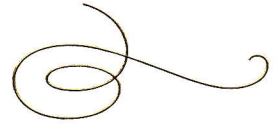
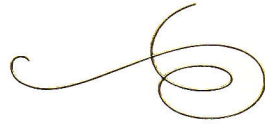


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*The Director*

*of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.*

*Therefore, this United States*

**Patent**

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

*Ander Lane*

DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE



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(12) **United States Patent**  
**Xie**

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(45) **Date of Patent:** **Jun. 12, 2018**

(54) **OIL CONTROL DEVICE FOR FULLY VARIABLE HYDRAULIC VALVE SYSTEM OF INTERNAL COMBUSTION ENGINE**

(58) **Field of Classification Search**  
CPC ..... F01L 9/02; F01L 9/025; F01L 1/34; F01L 1/344; F01L 2001/34426; F01L 2001/34446; F01L 2820/02; F01L 2820/03

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(Continued)

(72) Inventor: **Zongfa Xie**, Jinan (CN)

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(73) Assignee: **Shandong University**, Jinan (CN)

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 357 days.

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(21) Appl. No.: **14/902,268**

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(30) **Foreign Application Priority Data**

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(57) **ABSTRACT**

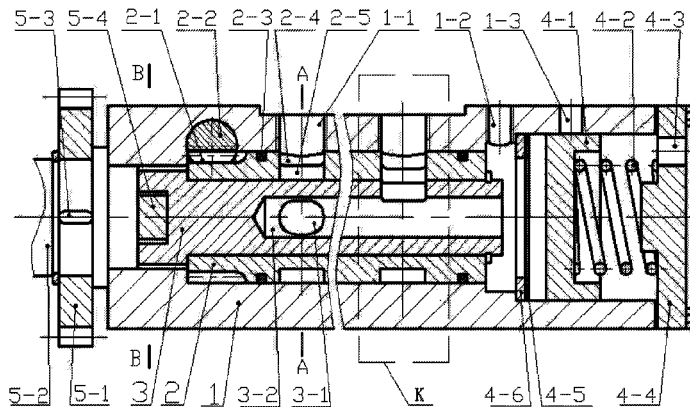
(51) **Int. Cl.**  
**F01L 9/02** (2006.01)  
**F01L 1/344** (2006.01)  
**F16K 11/076** (2006.01)

The present invention relates to a valve train mechanism and a fuel supply system of internal combustion engine, and particularly relates to an oil control device of a hydraulic fully variable valve system of the internal combustion engine. This device connected with the hydraulic valve system of internal combustion engine, the device consists of a housing, a rotary valve, a hydraulic accumulator and a transmission mechanism. The rotary valve, the hydraulic accumulator and the transmission mechanism are installed in the housing. The rotary valve consists of a rotary valve shaft and a rotary valve sleeve. The hydraulic accumulator con-

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sists of an accumulator piston, an accumulator spring, an end cover, a sealing seat ring and a rubber gasket and is installed in the cavity at one end of the housing. An accumulator chamber is provided between the rotary valve and the hydraulic accumulator. The transmission mechanism consists of a transmission gear, a gear shaft and a cross slide coupling. The transmission gear is installed on the gear shaft, while the gear shaft is connected with the rotary valve shaft through the cross slide coupling. The present invention can replace a high-frequency solenoid valve, it is applicable to use with hydraulic fully variable valve system of single-cylinder and multi-cylinder internal combustion engines. And the present invention has the advantages of simple structure, reliability, good manufacturability and low cost.

**4 Claims, 3 Drawing Sheets**

- (52) **U.S. Cl.**  
CPC ..... *F01L 2001/34426* (2013.01); *F01L 2001/34446* (2013.01); *F01L 2810/02* (2013.01); *F01L 2820/03* (2013.01)
- (58) **Field of Classification Search**  
USPC ..... 123/90.12, 90.16, 90.17  
See application file for complete search history.