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**Watanabe**

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(54) **VARIABLE DISPLACEMENT OIL PUMP**  
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See application file for complete search history.

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(57) **ABSTRACT**

In a variable displacement oil pump employing a return spring for forcing a cam ring in a clockwise direction, and a control chamber configured to displace the cam ring in a counterclockwise direction with a discharge pressure introduced thereto, a pilot valve is provided to selectively switch between an oil-discharge from the control chamber and an oil-introduction to the control chamber by moving a spool in one direction by a biasing force of a valve spring or by moving the spool in the other direction against the biasing force by the discharge pressure and applied at an oil introduction port of the pilot valve. Also provided is an electromagnetic valve configured to variably control timing at which switching between the oil-discharge and the oil-introduction occurs, with respect to the discharge pressure applied at the oil introduction port, by appropriately changing the preload setting of the valve spring.

**16 Claims, 18 Drawing Sheets**

