

Automatic Mechanical Tappet Clearance Adjustment Mechanism for Small Motorcycles Contributing to Emission Reduction

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With the recent tightening of exhaust emission regulations, the catalyst in motorcycle's exhaust system has been increasing its volume gradually, requiring a new technical measures to reduce emissions from the exhaust gas right after the combustion chamber rather than relying only on the catalyst while improving combustion in the low-load conditions to deal with Euro 5 OBD2 regulations. One of the technical options is such a method that controls release of unburned gas by reducing the overlap which occurs when the intake valve opens before the exhaust valve closes. The authors, et al have come up with such an idea that reduces the cam cushion ramp provided in the cam profile when opening and closing the valve. The cam cushion ramp is designed taking into account the valve being lifted slightly when it should be closed due to an elongation of valve stem when heated quickly, the difference of linear expansion coefficient of valve and cylinderhead and the changes of valve clearance due to aging. If the cushion ramp is reduced, the emission of unburned gas can be lowered. An option to reduce the cushion ramp is the lash adjuster that automatically compensates valve lash. However, as the conventional system is hydraulically operated, the hydraulic fluid has to be pressurized and hydraulic fluid passages have to be provided, which is why such a system is not common in small engines having a space limitations and a cost ceiling. To deal with the above-mentioned issues, we have developed the mechanically-operated automatic valve lash adjuster applicable to small engines without extensive modifications (Fig. 1). The new rocker arm shafts having an eccentric shaft, the sub rocker arms and the release cams are incorporated into the new system. A rotating force is provided to the eccentric rocker arm shaft by the return spring on the same shaft. The rotating force causes the center of the eccentric shaft to move downward, which presses the sub rocker arm downward. The cam lobe contacts the sub rocker arm and at the same time the rocker arm contacts the end of valve stem, thus eliminating valve lash. If these conditions are maintained when the valve stem elongates when hot, the valve remains slightly lifted even when it should be fully closed. The release cam is therefore incorporated to reset valve clearance to zero at each cycle. There were two issues in the new idea.

- (1) How to maintain sealing for the valve that settles in the valve seat in two steps
- (2) How to prevent unintended rotation of the eccentric rocker arm caused by the rocker arm motions

Regarding the two-step seating load, it has been confirmed that the valve seal-ability is unaffected when setting each seating load at approximately 1/2. Regarding the unintended spinning of the eccentric rocker arm shaft, a workable zone has been determined from the friction spring force and the return spring torque.

We have confirmed that an application of this system reduces emissions of the unburned gas from the combustion chamber and improves combustion in low-load conditions. We believe that this system applicable to small engines will be useful in small motorcycles and scooters, which are high volume sellers among various motorcycle segments, to deal with ever-tightening emission regulations.

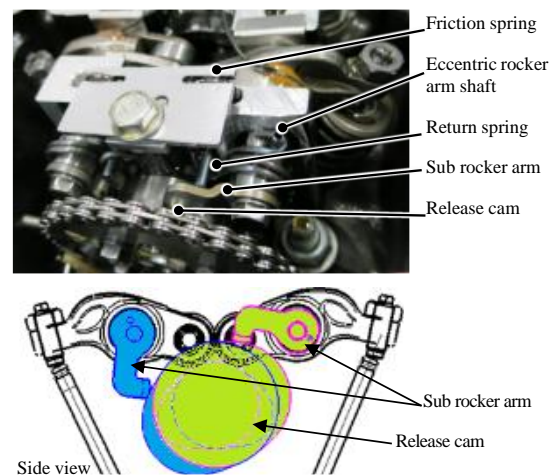


Fig. 1 Picture/side view