

Eco-friendly non-return valve for two-wheeler engines⁴⁶

Arvind Janardan Khandke (54), a 9th grade pass out, hails from Kolhapur, Maharashtra. A cloth merchant by profession, Khandke is an auto enthusiast obsessed with fuel conservation. His hobbies include research work and reading as well as swimming. His aspiration is to pass on something valuable to the next generation. His family comprises his wife, four daughters and a son. His monthly income is Rs. 7000 per month.

Genesis Arvind Khandke is a cloth merchant who owns a handloom saree shop in Kolhapur. As part of his business, he used to travel a lot on his Rajdoot motorcycle (manufactured by Escort). While riding the motorcycle he was often troubled by the engine vibration and the high fuel consumption. This forced him to think of developing a device which would overcome the above problems.

While studying the process, one day in 1980 he found that the air filter was oily and he inferred that there was some loss as the air fuel mixture from the cylinder rebounds and was escaping from the carburetor. To stop that wastage, he decided, to fit a valve type device. Thus in 1983, he designed the first prototype of the valve out of mild steel. But during the trials he found that the flap of the valve was too heavy to work effectively. He changed the material of the flap and designed a new valve using nylon and Poly Propylene to suit 1 HP to 1.25HP engines.

Some of the problems he faced while developing this innovation were the lack of proper operation by experts in the field and non-availability of the laboratory/equipments for the testing of the products. While developing this innovation he recalls

that he was not able to concentrate on his business and family life and this single minded devotion has had an adverse effect on his financial position. He took about 12 years to develop the solution

The Innovation

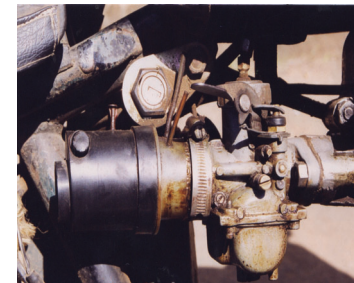
The non return valve is fitted between the air filter and the carburetor in the petrol engine and between the air filter and intake manifold in a diesel engine. It comprises main body having a hollow cavity within and an extended hollow neck at the end for connecting the same over the hose pipe of the carburetor. It essentially ensures fuller combustion of the air-fuel mixture in the combustion chamber and reduces the release of un-burnt fuel. Such un-burnt fuel causes pollution apart from reduction in fuel efficiency.

In existing engine designs, to take advantage of the inertia effect, the inlet valve remains open at about 40° when the piston reaches Bottom Dead Center (BDC) at the start of the compression stroke. At this time charge pressure is less than the compression pressure. So during this period, some of the charge escapes through the inlet valve through the carburetor and air filter. This cycle



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continues for every suction stroke of the engine. This leads to improper combustion due to inappropriate proportion of air and petrol. Due to this cycle the volumetric efficiency of the engine reduces and hence loss of power takes place. Arvind referred to these effects as "Bounce Back Loss". This loss increases with increase in speed because as the speed increases the valve opening time during compression stroke also increases. In addition, in existing engines, the air filter of the petrol engine tends to get clogged by the oil particles which catch and hold dust particles rendering the air filter element ineffective more quickly than otherwise. The filtering element in the air filter assembly is also expected to remain dry, but this is not the case. To solve this problem, some attempts were made to provide reed valve or rotary valve, the construction of which is quite complicated and hence it was not found suitable. But Khandke's Non Return Valve captures these losses by not allowing the return of the charge towards the carburetor or the air filter side of the petrol engine and thus increases the overall engine efficiency. The valve has to be replaced after 25,000 km and costs Rs.1000.

Testing

To prove the bounce back effect and its losses initially different trials were conducted. These tests were conducted without the valve and with the valve connected. These tests were conducted in the laboratory and on the roads also.

Tests were conducted for Carbon Monoxide & Hydro Carbon emissions on Enfield (350c.c) with and without valve at the Government Polytechnic at Kolhapur in 1999. At 120 rpm the % of CO reduction with valve is 8.3% while that at 2000 rpm is 19%. Also HC % reduction at 120 rpm is 28% while at 2000 rpm it is 82%. As speed rises the turbulence rises and with the valve, the combustion is effective and losses are minimal as compared to without valve condition.

To get the visual effect of the bounce back losses, the test was conducted on a Kawasaki Bajaj Boxer single

cylinder 100c.c engine in "Kaushal Auto clinic" Kolhapur and recorded on CD with the help of video camera.

Tests were also carried out on a Bajaj – Boxer (4 stroke engine of a two wheeler) at the PUC test centre of Associated Petroleum Corporation, C.G.Road, Ahmedabad in 2004 and the results turned out satisfactory.

However the results have not always been consistent and a need was felt for some improvement.

Current status

In 1994 Arvind Khandke was granted a patent for the use of this device in two- stroke engines. He then filed a patent application for the use of the device on 4 stroke petrol engines. Since 1996 to 1998 trials were conducted in the D. Y. Patil College of Engineering and based on the results some more modifications were done in the valve in 1999 and 2000. In 2001 he got the patent for four stroke engines. Since 1980 he has been investing his own funds to develop this innovation. This device has the potential to be used in all automobiles (2 strokes/ 4 stroke engines). He has been using it since 1982. The innovation was also featured in an article in the December 1997 issue of Indian Auto. Arvind got the first prize in the Innovation Fair at Avenues, 2004 the Technology Festival of IIT, Mumbai.

Applications in current scenario

As per present technology, it is considered that air pollution by vehicles is because of the emission from the exhaust, but Khandke has proved that the bounce back losses from the side of the carburetor also contribute in polluting the air. Scientists have been trying to reduce the pollution from the exhaust side (as per euro 1, euro 2 Norms) but they have not been thinking of incomplete combustion as a reason and at present there is no competitive technology innovation in practice. Hence this eco-friendly valve developed by Arvind assumes all the more importance as it looks towards a pollution free environment.