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Fabrication of Automatic Air Filter Cleaning System

Gaurav Balpande[1], Mayur Chaudhari[2], Prerit R. Lambhate[3], Ashish Lengure[4], Nalini Turare[5], Professor A.N. Lade[6]

Dept. of Mechanical Engineering, Dr. Babasaheb Ambedkar College of Engineering, Wanadongri, Nagpur, Maharashtra, India

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Abstract - *For any engine there is necessary to prevent the impurities from air so that engine should run smoothly. so for that we are using air filter. The Air filters is used for heavy construction equipment such as diesel engine or diesel cycle. For those which are used in little polluted area like in mines, industries air filter is important criteria. The air filter should be inspected, clean, and/or replaced every 15000 miles.*

These filters are specially constructed to allow a higher volume of air yet still filter out any debris. This is the reason a diesel air filter is much more expensive. As per our survey the air filter is clean by manually and it will take too much time to clean it or sometimes due to laziness of worker they do not clean properly. Sometimes because of manually cleaning it may be damage.

So we fabricated a such type of machine which prevents more time consumption and less human efforts to clean the air filter. The present air filter is works on the principle of pneumatic system. Nowadays, so many industries are interested to work on the base of automation that's why concerned with this concept of automation we fabricated air filter cleaner whose nominated as "Fabrication of Automatic Air Filter Cleaning System".

Key Words: (Size 10 & Bold) Key word1, Key word2, Key word3, etc (Minimum 5 to 8 key words)

1.INTRODUCTION

An air filter cleaner is a device which removes solid particulates such as dust, pollen, mold and bacteria which is collected from the air. Air filters are used in application where air qualities are important, notably in building ventilation system and in engines such as internal combustion engines, gas compressor gas turbine and other. An air filter is an important part of intake system of an automobile because it is through the air filter that the engine "Breaths". An engine needs an exact mixture of fuel and air in order to run, an all of the air enters the system first through the air filter. The air filter purpose is to filter out the dust and other foreign particles in the air, preventing them from entering the system and possibly damaging the engine. An air filters is a generally made up of fibrous material, pleated accordion-style. An air filter can also be made of cotton or fabric like materials which is then oiled in order to increase air flow to the filters.

The air filter cleaner is a de-clogging device. It is composed of two main components i.e. pressure vessel (storing air pressure/ air compressor) and triggering mechanism (high speed release of compressed air). It is a machine which clean the air filter automatically by using c-programming and electronic circuit. The present project is directed to an air filter cleaner which may be used on a job site to clean the air filter of construction equipment and vehicle during normally scheduled downtime. In the past, this air filter element where either cleaned by the process of spraying the compressed air from the hoses. This process was very time consuming and costly in terms of amount paid by the contractor to a mechanic for other person to have a filter clean. This manual cleaning of filter also often resulted in a pin holes or other damage to the pleated material of the filter. If the pleated material of the filter where damage, the filter would be useless and time invested in the cleaning of air filter would be a complete loss. Therefore, in the view of this hazards and the high cost of labor. The present invention eliminates the problem previously encountered. The present invention used the daily cleaning of air filters on heavy construction equipment during normally scheduled downtime.

1.1 Literature Review

[1] B. PAVAN KUMAR GOUD1, DR. S. CHAKRADHARA GOUD, studied on Experimental and Numerical Study on Performance of Air Filters for Diesel Engine, and found that The air filters in an air intake system permanently removes foreign particles such as dust, dirt and soot from the intake air, thereby maintaining the performance of the engine and

protecting it from damage. Proper maintenance can help vehicles perform as designed, thereby positively affecting fuel economy, emissions, and overall drivability. This paper addresses the issues of air filters replacement. Older studies of carbureted gasoline vehicles have indicated that replacing a clogged or dirty air filter can improve vehicle fuel economy and, conversely, that a dirty air filter can be significantly detrimental to fuel economy. In contrast, a recent study showed that the fuel economy of modern gasoline vehicles is virtually unaffected by filter clogging due to the closed loop control and throttled operation of these engines. Because modern engines operate without throttling, a different result could be anticipated. Today there are 30 to 40 different filter applications around the automobile to be found. The technological performance requirements of the majority of these products are usually more straightforward and are often but vaguely defined. This paper describes the measured results with focus on changes in vehicle fuel economy but also includes emissions and performance. Previous studies show that, replacing clogged air filter can improve vehicle fuel economy and conversely a clogged air filter can be significantly detrimental to fuel economy. The effects of air filters performance were studied and the analysis is carried out with different simulation results in the form of numerical simulation of flow particles captured by air filters.

[2] A. Janarthanan, R.Hariharan, V.Thirumalairaj, Dr.K.Chandrasekaran studied on Interfacing Of Automation In Air Filter Cleaner , and found that The air filters in an air intake system permanently removes foreign particles such as dust, dirt and soot from the intake air, thereby maintaining the performance of the engine and protecting it from damage. Proper maintenance can help vehicles perform as designed, thereby positively affecting fuel economy, emissions, and overall drivability. This paper addresses the issues of air filters proper cleaning. In contrast, a recent study showed that the fuel economy of modern gasoline vehicles is virtually unaffected by filter clogging due to the closed loop control and throttled operation of these engines. Because modern engines operate without throttling, a different result could be anticipated. This paper describes the measured results with focus on changes in vehicle fuel economy but also includes performance. The effects of air filters performance were studied and the analysis is carried out with the different diesel engine of cleaned air filters.

[3] Krunal K Parmar, Shailesh M Patel studied on an Effect of Atmosphere on Fuel Economy & Air Consumption through Clogging of an Air Filter & found that Auto motive is self-propelled power generating device which used atmospheric air to optimize the complete combustion of a fuel. In today's world utilization of automotive is increases as well as increase of pollution with industrial development. Recently due to increase in rapid development of industries increase the number of automotive used to achieve the requirement. To increase the efficiency expects of designing it should be focus to achieve a complete combustion of fuel to improve an efficiency of an engine. Efficiency of an engine depends upon combustion of a fuel that mainly depends upon the supply of Stoichiometric air. Air is supplied through air filter but due to different climate condition clogging of air filter reduce the supply of an air. This reduction of air to engine leads to loss of fuel due incomplete combustion and increase economy loss.

[4] Dharm Dutt, A.K.Ray , C.H.Tyagi, J.S.Upadhyay & Mohan Lal studied on Development of Specialty Paper is an art: Automobile filter paper from Indigenous raw materials and found that The major obstacle for the development of various types of filter papers is the shortage of good quality of fibres in order to impart properties like mean pore diameter, micron rating, optimal porosity and general wet web strength for run ability of machine and non-availability of technology. The study aims at developing various kinds of filter papers from raw materials available plentifully in INDIA.

[5] Maris Gailis, Vilnis Pirs studied on RESEARCH IN INFLUENCE OF ENGINE AIR FILTER REPLACEMENT PERIODICITY and found that The study evaluates current periodicity of engine air filter replacement to determine the influence of this operation on some vehicle performance parameters. The experience of usage, costs of exploitation and technical condition of the vehicle are connected with a technically and economically based system of technical servicing. Periodicity of motor air filter replacement, declared by the automobile manufacturer Renault ranges from 30 000 km to 120 000 km, depending on the model and engine type. According to the same recommendations, periodicity must be reduced by a half, if conditions of use include dusty roads and exploitation of the vehicle in urban conditions. The aim of the research is to evaluate the criteria, according to which actual replacement of motor air filters was performed and to measure the influence of air filters with different levels of use on the engine performance. To reach the goal, air filter cartridges from 100 vehicles of the same model and type, which were used in Latvia were collected. The influence of air filter clogging on several vehicle exploitation parameters, such as engine power and fuel consumption was analysed. The value of maximum permissible pressure difference before and after the air filter was determined. Air filters, collected from vehicles, were

tested on the test bench for the value of air pressure difference. The results obtained with all the samples have been presented and critically examined.

[6] de Amaral, T., Zeller, A., de Azevedo, E., Yoshino, F. et al studied on Air Cleaner Performance Improvement through Multicyclones and found that Air cleaners are used in a wide range of automotive applications. From passenger cars to heavy duty trucks, there is always an air cleaner to keep inlet air free of impurities and air flow passage obstruction in low levels. Today's automotive air intake systems are developed to deliver maximum filtration efficiency, maximum dust holding capacity and maximum service interval range based on engine performance and reliability requirements [1]. In Brazil, some applications require outstanding performance for the air cleaners. One of them is at harvester application. In this case, vehicles are exposed to thin soil particles in high quantities due to harvester movement at plantation work. At the same time, engine performance needs to be kept during long journeys. According to this limitation, re-fueling and components replacements are done direct at field. Any vehicle stop means lower productivity and more costs. This paper studies the influence of multicyclones application at a harvester air cleaner system. Its compact size summed to high contaminant retention capacity improves usual air cleaner systems performance to longer service intervals with reduced pressure drop. Improvements on technology performance were demonstrated through numerical simulations and laboratory tests that simulate the actual application.

[7] Dipak C. Talele, Dr. Dheeraj S. Deshmukh, Dr. Prashant P. Boranare studied on A Review on Effect of Air Induction Pressure Variation on Compression Ignition Engine Performance and found that Owing to Concern of environmental pollution and energy crisis all over the world, research interest on reduction of diesel engine exhaust emissions and saving of energy is increasing. Because of Better fuel economy and higher power with lower maintenance cost, the popularity of diesel engine vehicles has been increased. Diesel engines are more economical than any other source in this range for bulk movement of goods, powering stationary/mobile equipment, and to generate electricity. The air induction system plays important role in combustion process by providing necessary air charge in case of Compression Ignition (C.I.) engine. Pressure drop across air intake manifold has significant effect on the indicated power of C.I. engine. To improve the volumetric efficiency, majority car manufacturers place air grill at the front of a vehicle. In this Paper, the causes and effect of air induction pressure variation on performance of compression Ignition engine is studied. It is observed that due to increased inlet air pressure results in better mechanical efficiency, volumetric efficiency, scavenging and reduced exhaust temperature at the engine exhaust thereby reduced oxides of Nitrogen.

1.2 Methodology

[1] Arrangement of an air filter on disc connected by the rotor which is mounted on the base of the assembly and fixed with the help of clamp.

[2] The aluminium frame mounted on the base which consist of pneumatic cylinder having solenoid valve switched by the ATmega-16 microcontroller with c-programming for reciprocating motion of pneumatic cylinder. Incoming air from the compressor is distributed to the nozzles through pipe.

[3] After switching on the solenoid will activate and control the reciprocating motion of pneumatic cylinder and at same time motor also start and rotate the air filter in same direction.

[4] Air pump is used to run the pneumatic cylinder.

[5] The external compressor connected to the pipe which supply the compress air through the pipe and finally through the nozzle.

[6] Because of rotating motion of an air filter and reciprocating motion of the nozzle, the incoming compress air from the external compressor helps to remove maximum amount of particulate collected on the air filter from the environment within short interval of time. And hence the air filter will be clean.

2. Working Principle

[1] Our project is working on the principle of pneumatic system.

[2] The system which use compressed air for various application.

[3] The system which makes use of compressed air to obtain the mechanical motion & mechanical work.

3. Ease of use

[1] Fully automatic, with high accuracy.

[2] Average cleaning time is less than five minutes.

[3] Reduce human efforts.

[4] Low maintenance cost.

[5] Less construction cost.

[6] Increased throughput or productivity.

[7] Improved quality or increased predictability of quality.

[8] Improved robustness (consistency), of processes or product.

[9] Increased consistency of output.

[10] Reduced direct human labor costs and expenses.

[11] Reduces operation time and work handling time significantly.

[12] Does not remove protective percolating.

Table -1: Sample Table format

Sr. no.	Time required to clean (sec)	Average time (sec)
1	80	
2	100	
3	60	83.33
4	120	
5	80	
6	60	

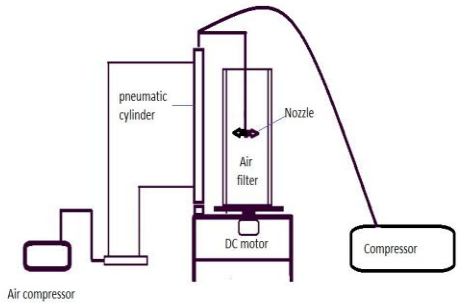

Fig -1: Fabrication of Air Filter Cleaning System.

3. CONCLUSIONS

[1] Thus we conclude that by using this setup it reduces the human effort as well as time required for cleaning per unit.

[2] In a minimum of time this set up can be used to clean many units of air filter at a time.

[3] Thus it reduces the wastage of air filters which we used to replace earlier.

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