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Development of Mechanical Fuel Injector Testing Machine in Cost Effective Manner

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Abstract: *When gasoline injectors get contaminated, it creates block in gasoline glide and incapable to allow spray sample for idea combustion. In the current marketplace Fuel Injector testing computing device is used to test the injectors with the contribution of controlled spray system for gasoline. Our team designed and fabricated a manner fuel injector testing machine at very cost-effective price which is 10 time less than existing machine present in market. Our project work explaining how we convert electrical gasoline injection machine into mechanical kind fuel injection machine is price effective, physically operated, multiple flow, single man powered and equally environment friendly with electrical system.*

Keywords: Injector, Air Cylinder, Fuel Cylinder, etc.

I. INTRODUCTION

Fuel injectors are designed to deliver a high-pressure mist of gasoline into consumption air, growing the explosive air-fuel mixture quintessential to electricity a vehicle. However, gas impurities will go away deposits in injectors, inflicting them to breakdown. Even if an injector isn't absolutely clogged, any obstruction of the gas go with the flow will trade the traits of the gasoline mist into the engine. Fuel that mixes poorly with the intake air is more difficult to ignite and burns less efficiently than well-mixed fuel. This is the most important problem caused by way of a soiled fuel injector. In turn, a vehicle will suffer from terrible gas mileage, more difficult starts, sluggish performance, greater dangerous emissions, and terrible idling. To fix fuel injectors' maximum overall performance and assist a car run like new, a driver needs a solution that will dissolve these deposits on their gas injectors. Fuel injector cleaners will do just that. Effectively detoxifying your vehicle, these solvents have a tendency to include a detergent like polyisobutylene to dispose of sediment and construct up, polyether amine to ruin the molecular bonds of strong deposits, and/or polyisobutylene amine to get rid of moisture.

II. LITERATURE REVIEW

Schuckert et al. explored the connection between aging of injector and fuel conveyance rate. The results showed that decreased cross segment of the injector openings because of store development doesn't be guaranteed to prompt diminished fuel conveyance rate at short infusion times. Water driven peculiarities cause the infusion time to be longer at a similar stimulating time, in this way making up for the lower fuel stream rate.

Hofmann et al. proposed a calculation for infusion procedure amendment to make up for changes coming about because of aging of injector.

A later pattern in fuel infusion reproduction has been trailed by **Smith and Timoney (1992)**. Their methodology has been to re-enact the nozzle just and utilize tentatively estimated boundaries as contributions to these models. These information sources can comprise of the line pressure (nozzle end), the needle lift or even the ignition chamber pressure. The utilization of trial inputs diminishes the requirement of modelling and decreases the requirement for 're-tuning' constants for the most part connected with factors like leakage of fuel.

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Birgel et al. reviewed the literature on their effect on the characteristics of injector and the mechanisms for the formation of deposit at the injector. The fuel flow rate across the injector reduces linearly during this operation were shown by the Researchers, which resulting in a corresponding decrement in the power of engine. Following 30 hours of engine operation at full load, the fuel delivery rate was reduced by about 3.5%. The literature review shows that shows that the effect of biocomponent on the formation of deposit at the injector are majorly focused. Generally, hard polymers are formed by the induced biofuels insides the injectors and deposition of carbon at the circumference of the injector hole.

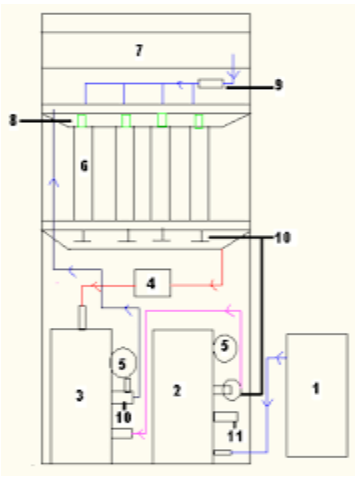
Recently**, Payri et al.** explored the impacts of aging of injector on numerous infusion procedures. The injector was exposed to wear on a test rig under controlled conditions. The researchers evaluated and observed the noticeable changes in the fuel flow rate in the injector, crediting them to diminished diameter of opening hole of injector.

III. WORKING OF FUEL TESTING SYSTEM

In this model we have a air cylinders to which strain gauge is attached and valve like protection and gate valve are also present. On the other side there we have gas cylinder to which additionally gate valve & and stress gauge are connected and all are fixed at iron frame. Then with the help of external supply know as air compressor by which air cylinder gets filled with air i.e., up to 40-50 psi, this pressure can be measure with the help of gauge know as pressure gauge and we also have security valve know as pressure comfort value this valve is used when excess amount of air is filled and to release this air, we open the gate valve and skip at the air into the gasoline cylinders. Then in the gas cylinder we have the combination of air and gas which is connected to in fuel rail to which injectors connected & air fuel mixture goes into the injector through. the pipe and as we supply the electric current of 2 amp & 12 volts, the pore of injectors gets open and these pores are open for 100-120 sec continuously and so we have continuous injection of fuel in the beakers which are attached to the wooden block. After this operation the operator check and measure the amount or level of the breakers and if the level of the fuels in each beaker are seen to be up & down, then it shows injectors are not in good shape or clogged with carbon or dust (un burnt) particle and so that this injector required cleaning and if all the fuel level in the beakers is nearly same then the injectors are fine & doesn't require cleaning. After the completion of this operation the gate valve present at the bottom of the beakers is opened so that the dirty fuel goes into the gas cylinder and there is a fuel filter placed between the gas cylinder and beakers, so that the dirty fuel gets filter & goes into the fuel cylinder.

IV. EXPERIMENTAL SETUP DIAGRAM

MODEL



LINE DIAGRAM

1. Air Compressor

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2. Air Cylinder
3. Fuel Cylinder
4. Fuel Filter
5. Pressure Gauge
6. Beakers
7. Transformer
8. Injectors
9. Connector
10. Gate valve
11. Safety valve

V. DESIGN AND COST BALANCE SHEET

Design

In this design we have a cylinder of capacity of 3L in which air is filled from air compressor. We also use gauge like pressure gauge & and valve like safety and gate valve which are attached to the cylinder and for the fuel cylinder which has capacity of 3-4L, which is use to fill the fuel and the pressurize air so that we obtain proper air fuel mixture. Here also we have attached pressure gauge and gate valve and all this arrangement are fixed at iron frame.

The fuel rail which is present at the top has length of 28 cm to which fuel injector are connected and at the bottom of each fuel injector the beakers are placed for the collection of fuel, these beakers are attached on the wooden block. This each beaker is of 100ml of capacity. The outlet from the breakers is attached to the fuel cylinder and in between we have fuel filter attached so that the dirty fuel from beakers gets filters & and goes into the fuel cylinder. If the dirty fuel goes into the fuel cylinder unfiltered then there will be the formation of sludge which will cause blockage and so fuel cylinder will not work properly.

Total Cost for framework

Project Part Cost	- 7800
Maintenance Cost	- 1000
Transportation Cost	- 1500
Total Cost	- 10300

VI. RESULTS AND DISCUSSION

In this study we have 1 minute of continuous injection of fuel from the injector of ALTO K10. This test was performed under no load condition on a test bench. This test was conducted at room temperature with injecting the air fuel mixture. After completion of all operations, we obtain injection rate characteristics. The results obtained by these operations are as follows:

Observation Table

Injector No.	Fuel Injected (ml) Per Minute
Injector 1	72 ml
Injector 2	67 ml
Injector 3	70 ml
Injector 4	45 ml

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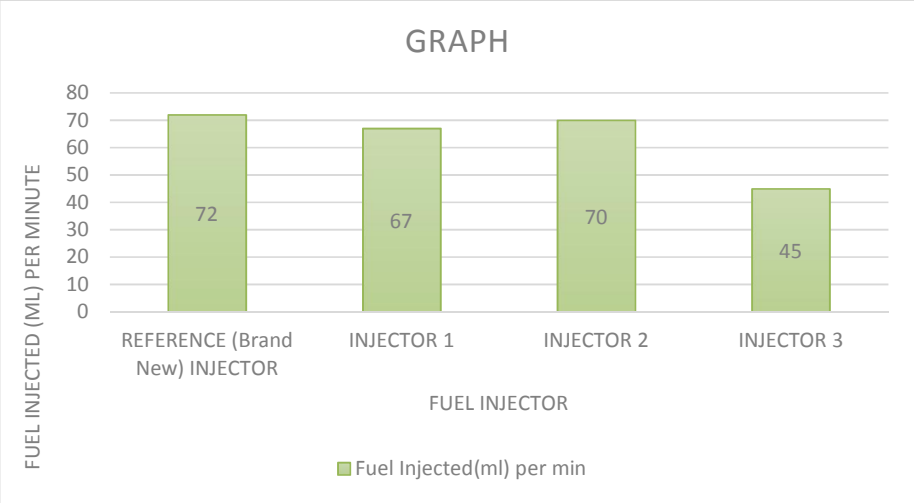

VII. CONCLUSION

1. In all tested injectors, statistically significant changes were observed with respect to the flow of air water mixture through nozzle.
2. The performance of the injector with respect to the heathy injection can be compared that helps the maintenance person in planning injection cleaning.
3. The flow rate obtained by collecting. The quantity of fuel per minute given the amount of chocking of the injection nozzle. Lesser the flow rate, indicates that the injection is chocked to greater extent.
4. The amount of chocking in different injector can be compared.

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