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# Development of Compressed Air Charged Vehicle

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***Abstract*— Air powered vehicles are those which can run on no external aids. In spite of electrical vehicles, these vehicles do not wait for recharging for longer period of time. Refuelling is easier and can be done in fraction of minutes. Most importantly it is having utmost same efficiency without compromising any kind of losses. At present the air technology in the automobile sector is very scarcely been used because of their low range of travel with single fueling. Our system deals with an attempt to make a more efficient air engine to give few more miles to get incorporate with. An attempt is made to convert two wheeler in compressed air charged rotary engine system, by providing air drive with specialized air tank which can hold up to 300bars or 4000psi of pressurized air to reduce space required for fuel (air). Rear wheel drive will serve initial pick up torque which will help the required modifications to vane angle as low as possible.**

***Index Terms*— Rotary Engine, Compressed Air, Vane, Alternate Energy, Automobile**

## I. INTRODUCTION

Because of global problems such as greenhouse effect, ozone layer depletion, acid rain, air pollution our total life of our planet is reducing day by day. These factors are leading automotive technology and development of alternative energy sources. Some of them are electrical powered, solar powered, hydrogen powered, etc. but before we utilize and

Compressed air is having energy stored within. This energy can be converted into required output by expanding it to atmospheric pressure. This air without external chemical or physical support is having potential to generate output work. As it is green and clean type of energy environment and roadside issues can be neglected. We are planning to replace four stroke fossil fuel engines with air charged rotary engines. Without any complexity, we are planning to develop three vane type rotary engines with rotor diameter of 30±2 mm for automotive use. And we are planning to introduce new materials to amplify life and workability of machine as prescribed below.

## II. EXPERIMENTAL SETUP

### METHODOLOGY

With low aspects assumed we can manufacture, vane type rotary engine which runs on rotary compressed air, to optimize its performance with respect to automobiles. The design of this system can replace four stroke and 2 stroke single cylinder air cooled 100-150 cc engines, in bikes. Following steps are incorporated in development of air charged vehicle:

1. Designing of rotary engine.
2. Fabrication approach.
3. Assembly.
4. Stationary Testing.
5. Final Testing.
6. Cost report.
7. supply and help ventures

Following design is an assembly of final product been manufactured? Moreover, development of this design is according to rotor to casing diameter as per researched in earlier era. Dimension mentioned in diagrams are having tolerance limit of ±0.03mm. Actual manufactured parts are prepared in three sets for safer test and flawless set up. But only one set served the system analysis until now. Including Pressure vessel and pressure regulator are as per specification and are not designed by us. They were compared to our specifications and bought as per requirement. Accelerator is a mechanical linkage controlled by wire drive and was chosen because of there greater life and reliability.

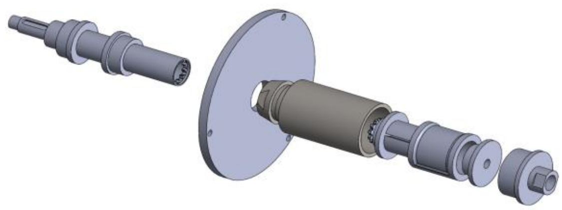

**Fig 1:** final assembly of shaft and components

| PART NAME | MANUFACTURING PROCESSES |
|---|---|
| Motor casing | Casting, turning, threading, drilling |
| Mother Plate | Turning, Drilling |
| Rotor | Turning, Grinding, Milling |
| Rotor Casing | Casting, Drilling, Turning, Grinding |
| Vane Blades | Punching |
| Geared Shaft | Milling, Grinding |
| Cover Plates | Casting, Turning |
| Hose | Cutting, Clamping |
| Air Cylinder | Readymade |
| Pressure Regulator | Readymade |
| Hose holding clips | Readymade |
| Multi Step Shaft | Turning, Threading, Grinding, Millling |
| Pressure vessel Mountings | Cutting, Welding |
| Solenoid Accelerator Controller | Readymade |
| Assembling | n/a |
| Test Vehicle | n/a |

**Table 2:** Manufacturing Processes

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**Fig 3:** Without load Testing

## III. RESULTS AND DISCUSSION

**Fig 4:** Final Test Run

| RESULTS | DATE (dd/mm/yyyy) | TANK PRESSURE AT START (bar) | TANK PRESSURE AT END (bar) | TIME OF RUN (hh:min) | DURATION (min) | TOTAL DISTANCE TRAVELLED (km) | TOP SPEED (km/h) | TRAFFIC DENSITY | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| TEST RUN 1 | 01/05/15 | 150 | 100 | 12:15 pm | 2 | 0.5 | 0 | low | Technical Failures |
| TEST RUN 2 | 03/05/15 | 100 | 30 | 4:30 pm | 3 | 0.8 | 0 | low | Technical Failures |
| TEST RUN 3 | 06/05/15 | 150 | 0 | 10:30 am | 9 | 5.3 | 23 | medium | - |
| TEST RUN 4 | 07/05/15 | 150 | 0 | 2:00 pm | 12 | 9.2 | 31 | medium | - |
| TEST RUN 5 | 08/05/15 | 150 | 0 | 9:00 pm | 7 | 3.6 | 15 | high | - |
| TEST RUN 6 | 09/05/15 | 150 | 0 | 1:15 am | 14 | 11.2 | 43 | very low | - |
| TEST RUN 7 | 10/05/15 | 150 | 0 | 11:00 pm | 14.5 | 11.4 | 47 | very low | - |
| TEST RUN 8 | 11/05/15 | 100 | 0 | 7:00 am | 10 | 8.1 | 48 | very low | - |

**Table 3:** Result Summary

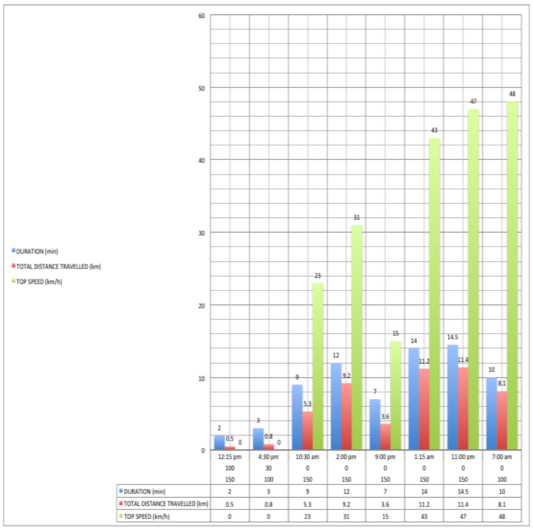

**Fig 5:** Graphical Representation of Results

## IV. Discussion

As per the results we got and after doing uncertainty analysis, we found that:

1. Test run no. 1 and 2 were failure because of fabrication errors and mechanical failures.
2. Test run no. 3 and 4 were having quit promising results.
3. Test run no. 5 was with traffic and motor drained huge amount of air is initial accelerations.
4. Test run no. 6,7 and 8 were considered actual tests while calculating time required for full drain of full 150 bar pressurized air storage.
5. Test result shows air consumption of 0.4 m3/min which is very near to theoretical air consumption 0.39m3/min. This validates our testing considerations and parameters taken while testing.Initial accelerations requires 8 bar pressure at inlet of motor which is increasing consumption. While at idling and cruzing speed this pressure decreases to 5 to 6 bars only.

Many areas are prone to leak air at high pressure. This are must be areas taken into high priority considerations.

## CONCLUSION

At the completion of the project we concluded that

- One full tank can serve up to 15km after optimization.
- Including maintenance charges and refueling charge of tank, it takes Rs.1.75 per km which is very low compared to conventional I.C.Engines.
- Maintenance of the system is very negligible compared to conventional I.C.Engines.
- With the help of testing parameters we can say that by using specialized compressed air storage tank with 350 bar, vehicle can run up to 30-35km which is very promising result in finding alternate to conventional I.C.Engine. One can manage 2-3 storage tanks to increase the next fueling time upto 70-100km.
- No pollution air engine is proved to give initial torque and similar properties to I.C.Engine.
- Cost of this system is extremely low when compared with Electrical Vehicles, Conventional I.C.Engines and other Hybrid Systems. This system is cleaner than hydraulic systems. Because of previous mentioned conclusions, we can say that air engines are one of the best alternate to conventional internal combustion engines and can shape the future in a green and clean way.

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| STATICS OF TODAY’S TECHNOLOGY | | | | | | | |
|---|---|---|---|---|---|---|---|
| Vehicle's Category | Fuel Economy (kmpl eq.) | Range | Production Cost for given range | Reduction in CO2 | Major Pollutants | Maintanance Grade | Speed Range (kmph) |
| Conventional I.C.Engine | 10 to 78 | Long | Medium | 0% | CO, HC, $NO_x$, etc. | Medium | 50 to 447 |
| Biodiesel | 18 to 71 | Long | Medium | 20% | Aldihydes, CO, Particulate Matter | High | 50 to 200 |
| All-Electric | Battery (upto 30) | Shorter (75-100) | High | 100% | Lead, Acid Wastes, $SO_3$, etc. | Extremly High | 50 to 250 |
| Compressed Air | 30 to 60 | 50 to 75 | Low | 100% | None | Low. | 50 to 150 |

**Table 1:** Statics of today’s technology