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Design and development of compressed air – engine

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Abstract: The compressed air engine is an eco-friendly engine which operates with the help of the pressurized air from the compressor to create the eco-friendly environment. The pneumatic actuators are used to expand the compressed air to give the useful work of it. The pressurized air from the compressor entering into the combustion chamber which pushes the piston to move downwards from top dead center to the bottom dead center to create motion, the torque is very much important in this aspect to give support to initiate motion with load. When this compressed air expands, the energy is released to do work. The valve operated engine was taken for experimentation were the inlet air again circulated when the piston tend to complete one cycle of operation that is from top dead center to bottom dead center and again bottom dead center to top dead center. Usually in a four stroke engine two cycles are required to complete a combustion process, but here it is changed to increase the power of the engine as it is operated by means of compressed air. Different experimental investigations have been performed over this model to identify the variations in different parameters like torque, rpm with respect to the input pressure. Early cost analysis shows that it's very cost effective and the operational cost is ten times less than that of petrol or diesel. However, the performance characteristics like brake power, mechanical efficiency have been found to be within the acceptable limit.

Key words: compressed air, air engine, two strokes, no pollution, four strokes.

I. Introduction:

The demand for conventional fuel are rapidly increasing day-by-day. Number of vehicle owners and the vehicles are also rapidly increasing. Need for an alternate solution which helps in some percentage reduction of conventional may fuel are the main theme of the project to develop like this will be an economical and ecofriendly too. Too many of those are the single runner of vehicle to their office with that inconsideration an air- engine has been developed to carry an average load of up to 100kg for running up to 5 to 10 km of office. The working model of this has been developed and is for analyzing it in details. Conventional fuels (i.e., coal, petrol, gas, natural gas), were the globally satisfying one, which helps the earth to turn around by means of them (Fossil Fuels).The combusted gas from the exhaust of automobile, industrial usage, which causes acid rain, ozone layer depletion, greenhouse effect, etc. In our country also in so many cities vehicle are operated in controlled way so as the government may take necessary steps to overcome these problems. Surely an alternative fuel are in need to satisfy the present and future requirement and researches are on process and alternate fuels and alternate fuelledvehicle, hybrid vehicle are all in operation in 5% of cities all over the world but in 95% of the cities depends on the fossil fuel. If the air-engine which was already an existing one, which requires an operation of minimum of 30km were the 20% of vehicle operator running km per day may help and join in the fuel revolution or alternate energy revolution. The main factor that affects the development of air-engine is the compressor which may of heavy in nature and require to operate it too to generate the compressed air. So while designing the air-engine one need to consider this also to successfully test and exhibit his findings.

II. Literature Survey:

A compressed air vehicle is powered by an air engines, using compressed air, which is stored in a tank. Instead of mixing fuel with air and burning in the engine it to drive pistons with hot expanding gases; compressed air vehicles (CAV) use the expansion of compressed air to drive their pistons. The use of that air in the engine is 90 per cent efficient. The principle of the air engine is derived from the steam engine in which the pressure energy of steam is converted to kinetic energy. The air engine uses compressed air instead of steam. The compressed air has pressure which on expansion moves the piston (linear motion) which is converted to

rotary motion through crank and connecting rod mechanism. In the compressed air engine, the cycle of operation gets completed with two strokes of the piston or one revolution of the crank. The two strokes are:

i. Expansion or Power stroke
ii. Exhaust stroke

III. Fabrication Of Compressed Air-Engine:

The four strokes engine give two complete rotation to complete a cycle operation, here if it continues some imbalance may occur. In this project the combustion cycle have to be reduced to single cycle (one complete revolution) to complete the cycle of operation. In two strokes engine they follow port timing were as the loss of power occur due to the cyclic operation of the engine. The transverse port and the exhaust port simultaneously opens to start and stop of the operation. When the compressed air entering into the combustion chamber and thus the compressed air lose its pressure because of expansion occur inside the combustion chamber while entering itself. So in this design and development of air-engine we have taken four strokes petrol engine for testing and analysis of the air-engine to develop it into a full working model.The factors which taken into consideration is reducing the cyclic timing by making changes in the cam follower through which the valves are operating timing. The timing is very important here by means of timing the efficiency of the engine may increase. The operation pressure requirement are all well maintained in the combustion chamber through which the operation of the engine or the efficiency of the engine may increase.

Next we need to concentrate on frames and structures to accompany the engine for transportation. As we discussed early that it is designed for carrying a single person to satisfy the 20% of the office goers who are operating the vehicles in single operating. The compressor loaded here is a basic load and the person as secondary load, both the load accumulated and additional allowable load and clearance loads are included to complete the action of the vehicle. The frames are too strong and are build using light weight steel structure through which it may decide to conclude the operation and efficiency of the vehicle. Increasing load will improve the stability of the vehicle but decreasing the load may help us to improve the efficiency of the vehicle for what the research mainly carried out.

The engine assembles in the frame with cyclic circuit with one seat and the carrier to carry the load by which it may develop as a full vehicle for operating condition. The compressor assembled at the end of the vehicle over which the load carrying space were provided on it to dissipate the load evenly considering all the factors the design and load distribution factors are correctly developed and are explained in the main process.

IV. Assembly of Other Accessories

The other accessories include fuel tank, seat, accelerator pedal, start and stop switch, CDI, Exhaust silencer etc. The fuel tank was positioned near to the air tank. Seat was placed at an appropriate distance from the steering. The accelerator pedal and brake pedal was provided at the front portion of the steering. Start and stop switches were provided for IC engine and DC compressor. CDI is used for starting IC engine which was positioned above IC engine. Silencer was installed with the IC engine exhaust side. Then several electronic connections were made

V. Working

Starting can be made with either air or IC engine. We prefer air engine for simplicity. This is because our design was made simpler and starting air engine requires some procedures to be followed which can be automated in future. The starting of air engine is as follows: 1. Apply the kicker first 2. Now open the ball valve to the engine entry 3. Now regulate the air flow 4. Now take the gears as of wish 5. Keep regulating air for speed control along with gears 6. Ensure the valve is closed after the run Starting can also be made with IC engine. For this a push to on switch is provided. Pressing the switch IC engines gets started. There is no gearing shifts required as it is made automatic. The speed can be controlled with help of acceleration pedals. The braking also provided with help of pedals. To stop the engine push to stop switch is provided which on pressing stops the engine. Switching refers to working between two power sources. As already said we had made parallel arrangement so that power can be taken from the desired one. We prefer to start the vehicle with air as said earlier. Then at a time when air reaches 2 bar we can turn on the IC engine by simply pushing the switch button. Thus the switching is being done. Also it is preferred to run the vehicle in traffic areas with air engine. This helps in reducing the fuel consumption by idling and also helps in reducing the pollution of traffic areas. Regeneration can be yielded by switching ON the DC compressor. Also the compressor can be started whenever desired allowing compressed air to be generated in the compressor tank. The air can also be generated from the air compressor in labs, petrol pumps etc. which refills much faster when compared to the DC compressor. A small compressor can also be brought home for the purpose. It is cost effective while comparing with the fossil

fuel and its emissions. Thus the replenishing can be done with a DC compressor, air compressor and from petrol pumps which can be done with less investment.

Fig 1.1 Engine working set-up

VI. Result and Discussion

The air-engine is one of the appreciable work in automobile sector because of what we may able to modify it for the required without investing much cost that is design and development of engine for operating air-engine. The only constraint in the air- engine is low load operating vehicle because of the engine and compressor itself occupies more load. As the design aspects of daily operation of too and fro of 30km which decreases the more difficult phase of designing the engine for this particular working. The next phase is we have chosen four stroke engine which is efficient for thistype in easy way but timing is an important one were the air circulation must be circulated well to avoid some problem which may considered to exist if there is no modification in cam or timing gear in the four stroke engine which is also modified and successful running of the engine was capture and load distribution curve also plot and is pictured in this paper. The objective of the work was mainly achieved with this evolution. The graph shows the speed versus torque were we may able to note the torque and speed proportion which are in required proportion and is in allowable limit to carry the design load . The second graph which describes the braking strength and pressure which explain the pressure generation and pressure requirement for the operation are all well discussed and are in good condition.

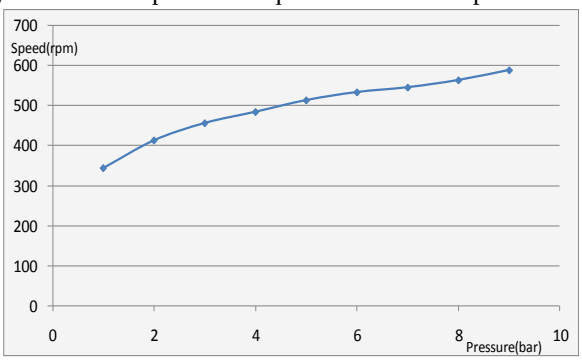

Fig 1.2 speed vs Torque

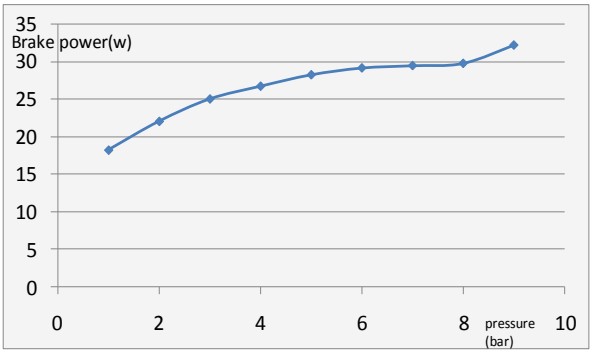

Fig 1.3 Brake power Vs Pressure

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