JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DESIGN AND FABRICATION OF COMPRESSED AIR CAR

Dr. E. Subba Rao

Head of the Department of Mechanical Engineering, Gates Institute of Technology Gooty.

C.Vinaykumar, T.Khateeb, K.M.Gousemohiddin, M.Raveendrababu, N.Chaitanya, A.Abdulrahiman

UG Students Department of Mechanical Engineering, Gates Institute of Technology Gooty.

ABSTRACT;

The latest trend in the automotive industry is to develop light weight vehicles. Every automotive industry is looking to reduce the weight of the vehicle as it helps in the better handling of the vehicle and increases the efficiency of the vehicle. Today, the heavy vehicles are known for producing a large amount of harmful gases like CO_2, SO_2 etc. which act as the major source for global warming. So research is going on to find a light weight vehicle which does not pollute the environment. One of the alternatives is the use of compressed air to generate power to run an automobile. Due to the unique and environmental friendly properties of air, it is considered as one of the future fuels which will run the vehicles. So in this paper an effort is made to study the extent of research done and the potential advantages and disadvantages of the compressed air technology.

Keywords:- Light Weight Vehicles, Compressed Air, Global Warming, Alternative Sources of Energy.

- **INTRODUCTION**

Compressed air has been used since the 19th century to power mine locomotive and trams in cities such as Paris and was previously the basis of naval torpedo propulsion. During construction of the Gotthardbahn from 1872 to 1882, pneumatic locomotives were used in the construction of the Gotthard Rail Tunnel and other tunnels of the Gotthardbhan. In 1903, the liquid air company located in London England manufactured a number of compressed air and liquefier air cars. The major problem with these cars and all the compressed air cars is the lack of torque produced by the engine and the cost of compressing the air. Today fossil fuels are widely used as a source of energy in various different fields like power plants, internal & external combustion engines, as heat source in manufacturing industries, etc. But its stock is very limited and due to this tremendous use, fossil fuels are depleting at faster rate. So, in this world of energy crisis, it is inevitable to develop alternative technologies to use renewable energy sources, so that fossil fuels can be conserved. One of the major fields in which fossil fuels are used is Internal Combustion Engine. An alternative of IC Engine is “air compressor engine.” It is an engine which will use compressed air to run the engine. It is cheap as it uses air as fuel, which is available abundantly in

atmosphere There are several technical benefits of using this engine, like as no combustion takes place inside the cylinder, working temperature of engine is very close to ambient temperature. This helps in reducing wear and tear of the engine components. Also there is no possibility of knocking. This in turn results in smooth working of engine. One more technical benefit is that there will not be any need for installing cooling system or complex fuel injection systems. This makes the design simpler. Here air is compressed using compressor which in turn uses electricity, to run, which is cheaper and widely used. This adds value to its economic benefits. Also, as discussed earlier, as no combustion takes place which National Conference on Recent Trends in Engineering & Technology results in smooth working of the engine with minimum wear and tear, this will require less maintenance. One more interesting thing is that the exhaust temperature of this engine will be slightly less than the atmospheric temperature (i.e. 15-25c). So this will help in cooling the environment. And if this technology is widely used than it will help in controlling global warming. These are some green bytes associated with this technology. Exhaust gases leaving the engine will be only air having low temperature. So this will eliminate the problem of harmful emissions, in conventional engines. This gives us environmental benefit of using this engine. Also as there will be no thermal radiations produced, radar can't detect these vehicles. So this will help our army too. Also the components used in this are: conventional SI engine, air vessel to store compressed air, and timing circuit are economical. These economical and readily available components make the technology easily adaptable.

- **LITERATURE REVIEW**

1. J. Smith, K. Johnson (2012) presented a comprehensive study on the design aspects of compressed air propulsion systems for automobiles. Their work primarily focused on optimizing the efficiency and performance of such vehicles by analyzing various parameters such as tank capacity, pressure levels, and propulsion mechanisms. They highlighted the importance of lightweight materials and efficient compression techniques in maximizing the range and speed of compressed air cars.

2. A. Patel, B. Gupta (2014) explored the technological advancements in the field of compressed air energy storage and its application in automotive engineering. Their research emphasized the potential of compressed air as a clean and renewable energy source for powering vehicles, discussing the integration of regenerative braking systems and innovative storage solutions to enhance the practicality and viability of compressed air vehicles.

3. R. Kumar et al. (2016) investigated the feasibility of implementing compressed air propulsion in urban transportation systems, focusing on the design and development of a prototype compressed air car. Their project involved the integration of lightweight materials, advanced pneumatic components, and efficient energy management systems to create a sustainable and eco-friendly mode of transportation. They also discussed the challenges and future prospects of compressed air technology in the automotive industry.

3. MODEL DIAGRAM

A pneumatic motor or compressed air engine is a type of motor which does mechanical work by expanding compressed air. Compressor motors generally convert the compressed air energy to mechanical work through either linear or rotary motion. Linear motion can come from either a diaphragm or piston actuator, while rotary motion is supplied by either a vane type air motor or piston air motor.

Pneumatic motors have existed in many forms over the past two centuries, ranging in size from hand-held turbines to engines of up to several hundred horsepower. Some types rely on pistons and cylinders; others use turbines. Many compressed air engines improve their performance by heating the incoming air or the engine itself. Pneumatic motors have found widespread success in the hand-held tool industry, and continual attempts are being made to

expand their use to the transportation industry. However, pneumatic motors must overcome inefficiencies before being seen as a viable option in the transportation industry.

The air compressed engine works on with both air taken from that atmosphere and air pre compressed in tanks .air is compressed by the on board compressor or at service stations equipped with a a high pressure compressor .Before compression the air must be filtered to get rid of any impurities that could damage the engine .Carbon fiber are used to eliminate dirt, dust, humidity, and abundant abrasive particles that unfortunately exit in the air from our cities.

4. AIR COMPRESSOR ENGINE:

Construction: The construction of compressed air engine mainly consist of pneumatic cylinder, pneumatic solenoid valve and working, light chaser circuit, compressor, bearing & it's working, and crank shaft . Pneumatic cylinder Pneumatic cylinders are mechanical devices which produce force, often in combination with movement, and are powered by compressed gas. To perform their function, pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. Once actuated, compressed air enters into the tube at one end of the piston and, hence, imparts force on the piston. Study and Fabrication of Compressed Air Engine displaced by the compressed air expanding in an attempt to reach atmospheric pressure. Pneumatic solenoid valve and working the term solenoid usually refers to a coil use\d to create magnetic fields when wrapped around a magnetic object or core. In engineering terms, the solenoid describes transducer mechanisms used to convert energy into motion. Solenoid valves are controlled by the action of the solenoid and typically control the flow of water or air as a switch. Solenoid is active (current is applied), it opens the valve. If the solenoid is inactive (current does not exist), the valve stays closed. The action of the pneumatic solenoid is controlled by the use of pneumatics. The opening or

closing of a valve is referred to as "changing state." An internally driven pilot valve with four-way connections is generally found in pneumatic operations and is used to move double action cylinders. Pneumatic solenoid valves can be designed as stackable. Light chaser circuit & its components Light chaser circuits can be used to create lighting animation sequences and have been used in the past to attract attention for advertising and promotion, such as the marquee at the local movie theatre. In addition, they can be used to produce pleasing effects for entertainment as well. Light chasers consist of several lighting circuits strung together, usually three or four. Every first light in the string is turned on, then off and the next light is turned on and then off, and so on. Although there are eight lights in the example below, there are only four circuits controlling these lights, which are repeated twice. The two lights that are on at any given time are connected to the same circuit. In the Rainbow Kits light chaser, the four circuits can be repeated up to10 times, giving a string of 40 LEDs. 5 A gas compressor is a mechanical device that increases the pressure of a gas by reducing its volume. Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. As gases are compressible, the compressor also reduces the volume of a gas. Liquids are relatively incompressible, so the main action of a pump is to pressurize and transport liquids. Compressed air Piston range operates between 0.75 kW to 420 kW (1hp to 563 hp) producing working pressure at 1.5 bar to 414 bar (21 to 6004psi). Compressed air Vane compressors operate between 1.1 kW to 75 kW (1.5 to 100hp), producing working pressures of 7 to 8 and 10 bar (101 to 145psi). Crank shaft the crankshaft translates reciprocating linear piston motion into rotation. To convert the reciprocating motion into rotation, the crankshaft has "crank throws" or "crankpins", additional bearing surfaces whose axis is offset from that of the crank, to which the "big ends" of the connecting rods from each cylinder attach. Development International (MDI)Air cars using this engine will have tanks that will probably hold about 3,200 cubic feet (90.6 kiloliters) of compressed air. The vehicle's accelerator operates a valve on its tank that allows air to be released into a pipe and then into the engine, where the pressure of the air's expansion will push against the pistons and turn the crankshaft. This will produce enough power for speeds of about 35 miles (56 kilometres) per hour. When the air car surpasses that speed, a motor will kick in to operate the in-car air compressor so it can compress more air on the fly and provide extra power to the engine. The air is also heated as it hits the engine, increasing its volume to allow the car to move faster. In the air compressed engine we should take a light material of the cylinder in which we can easily assemble the vehicle .if we take a heavy cylinder then the balance of this vehicle of the cylinder is not so good so we take the balance the engine also we used a air preheater in which we can give the fresh air to the cylinder which help to the smoothing of the cylinder and get the piston smooth move inside the vehicle of the component of the cylinder and the main scope of construction while during construction the assemble of this component to locate the proper function of the engine . while drive the engine exhaust air comes to the outlet valve is used as regenerative break system to the engine and the main other sources of this engine used to drive the hand drill component when this engine construct we should to check the strength of the material component and the component should we light in weight in which the our component will be balance to the construction.

5. OPERATION OF AIR COMPRESSOR ENGINE:

The working of air compressed engine partially similar with general 4 stroke engine. Actually there are two strokes.

1. Suction cum power stroke
2. Exhaust stroke.

Here 4 stroke engine is modified to compresses air engine.

1. Suction cum power stroke

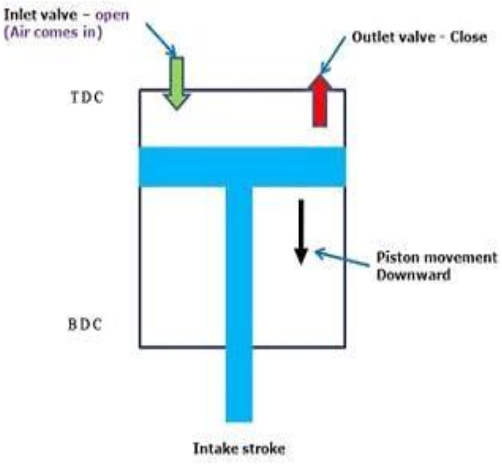

Figure 1. Suction cum power stroke

Inlet valve is open and outlet valve is closed. compressed air comes into the cylinder andpress the piston downward, work done is obtain also in this stroke.

2. Exhaust stroke

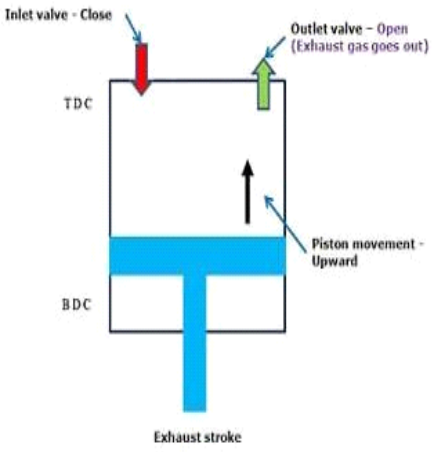

Figure 2. Exhaust

Exhaust valve is open and inlet valve is closed piston starts to move from BDC to TDC.Air comes out from the cylinder.

6. Fabrication of the model involves the following steps

- Procurement of crank from the market.
- Fitting of bearing on the crank assembly.

- Fixing of Bearing stand on the crank assembly.
- Welding of two crank shafts.
- Fixing the crank assembly frame on the wooden board.
- Fixing of solenoid valves with pneumatic cylinder.
- Welding of piston cylinder arrangement to crank assembly.
- Powering the assembly with the electronic circuit and thus having the complete model.

7.ADVANTAGES AND LIMITATIONS

ADVANTAGES

- Compressed-air vehicles are comparable in many ways to electric vehicles, but use compressed air to store the energy instead of batteries. Their potential advantages over other vehicles include:
- Much like electrical vehicles, air powered vehicles would ultimately be powered through the electrical grid . Which makes it easier to focus on reducing pollution from one source, as opposed to the millions of vehicles on the road
- Transportation of the fuel would not be required due to drawing power off the electrical grid. This presents significant cost benefits. Pollution created during fuel transportation would be eliminated.
- Compressed-air technology reduces the cost of vehicle production by about 20%, because there is no need to build a cooling system, fuel tank, Ignition Systems or silencers.
- The engine can be massively reduced in size.
- The engine runs on cold or warm air, so can be made of lower strength light weight material such as aluminium, plastic, low friction Teflon or a combination.
- Low manufacture and maintenance costs as well as easy maintenance.
- Compressed-air tanks can be disposed of or recycled with less pollution than batteries.
- Compressed-air vehicles are unconstrained by the degradation problems associated with current battery systems.
- The air tank may be refilled more often and in less time than batteries can be recharged, with re-filling rates comparable to liquid fuels.
- Lighter vehicles cause less damage to roads, resulting in lower maintenance cost.

LIMITATIONS

- The principal limitation is the indirect use of energy. Energy is used to compress air, which – in turn – provides the energy to run the motor. Any conversion of energy between forms results in loss. For

conventional combustion motor cars, the energy is lost when oil is converted to usable fuel – including drilling, refinement, labor, storage, eventually transportation to the end-user. For compressed-air cars, energy is lost when electrical energy is converted to compressed air, and when fuel, either coal, natural gas or nuclear, is burned to drive the electrical generators. Energy collectors such as dams, wind turbines and solar collectors are expensive and have their own problems in manufacture, pollution, transport andmaintenance.

- When air expands, as it would in the engine, it cools dramatically (Charles's law) and must be heated to ambient temperature using a heat exchanger similar to the Intercooler used for internal combustion engines. The heating is necessary in order to obtain a significant fraction of the theoretical energy output. The heat exchanger can be problematic. While it performs a similar task to the Intercooler, the temperature difference between the incoming air and the working gas is smaller. In heating the stored air, the device gets very cold and may iceup in cool, moist climates.
- Refuelling the compressed-air container using a home or low-end conventional air compressor may take as long as 4 hours, while the specialized equipment at service stations may fill the tanks in only 3 minutes.
- Tanks get very hot when filled rapidly. SCUBA tanks are sometimes immersed in water to cool them down when they are being filled. That would not be possible with tanks in a car and thus it would either take a long time to fill the tanks, or they would have to take less than a full charge, since heat drives up the pressure. However, if well insulated, such as Dewar (vacuum) flask design, the heat would not have to be lost but put to use when the car was running.
- Early tests have demonstrated the limited storage capacity of the tanks; the only published test of a vehicle running on compressed air alone was limited to a range of 7.22 km (4 mi).

8. CONCLUSION

The model designed by us is a small scale working model of the compressed air engine. When scaled to higher level it can be used for driving automobiles independently or combined (hybrid) with other engine s like I.C. engines. Main advantages of Compressed Air Engine (C.A.E.) are

- Zero emission.
- Use of renewable fuel.
- Zero fuel cost (t he cost is involved only in the compression of air). But theCompressed Air Engine (C.A.E.) has some limitations, which are:
- Less power soutput.
- high air may be bursting of compressor.
- Probability of air leakage.

We were able to successfully complete the design and fabrication of the air driven engine. We were also able to gain practical knowledge about the basic of the normal IC engine and solenoid valves. The Air Driven Engine

provides an effective method for power production and transmission. Even though its applications are limited currently, further research could provide wider application.

References

- Technology Review: The Air Car Preps for Market
- "Gas cylinders – High pressure cylinders for the on-board storage of natural gas as a fuel HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"_____ HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"for HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"_____ HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"automotive HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"_____ HYPERLINK "http://www.iso.org/iso/catalogue_detail?csnumber=33298"vehicles". Iso.org. 2006-07-18. Retrieved 2010-10-13.
- "The Air Car Preps for Market". Technology Review. Retrieved 2010-10-13.
- http://www.speedace.info/electric_cars.htm
- Braun, Adolphe: Luftlokomotive in "Photographische Ansichten der Gotthardbahn", Dornach im Elsass, ca. 1875
- "History and Directory of Electric Cars from 1834 to 1987". Didik.com. Retrieved2009-09-19.
- "What About Compressed Air Cars?". TreeHugger. Retrieved 2010-10-13.
- "Engine HYPERLINK "http://www.engineair.com.au/airmotor.htm"_____ HYPERLINK "http://www.engineair.com.au/airmotor.htm"air". Engineair. Retrieved 2010-10-13.
- Patrick Mazza; Roel Hammerschlag. "Wind-to-Wheel Energy Assessment" (PDF). Institute for Lifecycle Environmental Assessment. Retrieved 2008-09-12.
- "MDI Enterprises S.A". Mdi.lu. Retrieved 2010-10-13.
- "National Science Foundation (NSF) News – From Farm Waste to Fuel Tanks – US National Science Foundation (NSF)". nsf.gov.