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Compressed Air Engine Vehicle

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ABSTRACT: Now A Day, The Pollution In The Environment Is Increasing Due To Various Of Reasons. Air Pollution Due To Vehicles Is One Of Them, People Can't Stop The Usage Of Vehicles, Because It Has Become Time Saving Machine For Their Daily Travel. So Usage Of The Vehicles Can Only Be Minimized But Can't Be Stopped. The Best Solution To Overcome This Pollution Problem And Considering Economy Factors Is Replacing The Petrol Engine (Which Releases Exhaust Gas Like CO_2) With The Compressed Air Engine.

KEYWORDS:- Cam, Compressed Air Engine, Pressure Gauge, Storage Tank, 4 Stroke Petrol Engine.

I. INTRODUCTION

What Is Compressed Air Engine?

Compressed Air Engine Is A Type Of Engine Which Works On Principle That, Compressed Air Posses The Certain Energy, When This Compressed Air Is Sent To The Cylinder Of The Engine, The Compressed Air Gets Expanded And This Expansion Leads To The Movement Of Piston, Thus The Engine Runs.

Today's Generation Is Facing Major Problems Which Are Air Pollution And The Greatest Contribution To Air Pollution Is Automobiles Which Produces Gases Like CO_2, N_2 That Contribute To Air Pollution In The Atmosphere. The Vast Majority Of Vehicles Are Operating On Internal Combustion Engines Which Use Fossil Fuels Like Petrol, Diesel, Kerosene As Fuel To Run And Produce Many Un-Burnt Hydrocarbons Which Are Exhausted Into The Air And Also Release Gases Like Carbon Dioxide And Nitrogen Dioxide That Are Harmful For Plants And Animals. It Is Experimentally Found That The Efficiency Of These Vehicles Ranges From 72-95%. So This Can Be Considered As One Of The Preferable Choices To Run The Vehicle. There Is Need For Substituting These Fuels By More Eco-Friendly Fuels Like Air. Compressed Air Is Very Cheap As Compared To Other Kind Of Fuels. Air Could Be Compressed With The Help Of Compressor. The Vehicles That Run On Compressed Air Are Called Light Vehicles.

II. HISTORY

The First Evidence About Compressed Air Used In Vehicle Found In 17th Century, Which Is Used By Dennis Papin (Royal Society London 1687). While In 1872 The Mekariski Air Engine Was Used For Streettransport Consisting Single Stage Engine. However First Urban Transport Locomotive Was Introduce By Hoadley & Knight In 1898 & Was Based On Principle That Longer The Air Is Kept In Engine The More Heatit Absorbs And Greater Its Range. As A Result They Introduce Two Stage Engine. The Most Remarkablework Was Done By Charles B.Hodges Who Remembered As Father Of Compressed Air Concept Applied Incars Not Only Invent Car Driven By Compressed Air Engine But Also Got Commercial Success In It. Aftertwelve Year Of Research And Development Guy Negre Has Developed An Engine That Could Become Oneof The Greatest Technological Advanced Of This Century. He Is Of French Origin And Engineer Byprofession. Guy Negre Is The Head Of Research And Development At Moteur Development International(Mdi) Cars. Where Zero Emission Vehicle (Zev) Prototype Has Been In Production Since 1994.

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A Proved Fact:

“ Research By Mdi Shows That An Air Powered Car Can Travel 171 Km By Using Electricity Costing About Rs. 80-100 Which Would Cost About Rs.570 For A Normal S.I. Engine Car Giving An Average Of15 Kmpl.”

Usage Of Compressed Air

The Compressed Air Is Widely Used In,

1. Air Brakes.
2. Pneumatic Drills.
3. Pneumatic Wrenches.
4. Pneumatic Air Guns

III. MODIFICATION

Modification Of Single Cylinder Ic Engines To Run On Compressed Air

A Single Cylinder Ic Engines Are Modified So That It Can Run On Compressed Air And This Modification Can Be Done By Removing Some Parts, Replacing Parts And Adding Some Parts In Already Provided Engines. In Compressed Air Engines (Cae) Instead Of Mixing Of Fuels With Air And Then Burning It To Drive Piston, Compressed Air Engine Uses The Expansion Of Compressed Air To Drive The Engine.

Mainly There Are 3 Steps For Conversion Of Ic Engine To Compressed Air Engine.

Step 1.Removing The Not Required Parts Of Ic Engine.

Step 2.Replacing The Certain Parts.

Step 3.Adding New Parts.

Removing The Not Required Parts Of Ic Engine.

In This Stage We Remove The Parts That Are Not Required And This Stage Is Very Important In Modification Because These Parts Could Interrupt The Processes Of The Engine. In This Modification, Following Parts Are Removed.

- Carburetor.
- Exhaust.

Replacing The Certain Parts Of Ic Engine.

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This Stage Includes Replacing Of Several Parts In Order To Work With Compressed Air. Following Parts Are Replaced.

- Spark Plug With Air Inlet Valve.
- Fuel Tank With Air Tank.

Adding New Parts.

New Parts Are Added In This Stage To The Engine To Complete The Modification. Added Parts Are As Follows,

- Pressure Control Valve.

Important Parameters Considered Before Designing Air Vessels

A) The Air Vessel Should Withstand High Internal Pressure (Up To 360 Bars).

B) The Outer Body Of Air Vessels Should Be Made Of Material Having High Strength Like Carbon Fibers.

IV. CONVENTIONAL 4-STROKE PETROL ENGINE

Working Of 4-Stroke Petrol Engine

The Conventional Petrol Engine Consists Of 4 Strokes, They Are:

1. Suction / Intake Stroke.
2. Compression Stroke.
3. Power Stroke.
4. Exhaust Stroke.

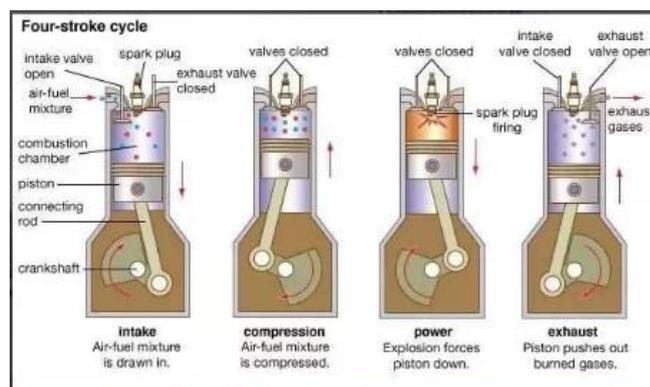


Fig: 4-Strokes Of An Ic Engine

- In Suction Stroke The Inlet Valve Is Made Open And The Air-Fuel Mixture Is Made To Suck.
- In Compression Stroke Both The Valves Are Made To Close And The Air-Fuel Mixture Is Compressed.
- In Power Stroke The Spark Is Fired From Spark Plug And Both Valves Are Made To Close.
- In Exhaust Stroke The Intake Valve Is Made To Close And The Exhaust Valve Is Made Open And The Exhaust Gases Exits The Engine Through The Exhaust Valve.

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Camshaft

The Camshaft Of Original Four Stroke Ic Engines Had Two Cams With One Lobe Which Were Mutually Perpendicular To Each Other. As The Crank Rotates, The Camshaft Also Rotates In Traditional Way And The Camshaft At The Inlet And Exhaust Both Have Functioning. Modified Camshaft Is Used In Compressed Air Engine. Now In The Modified Camshaft The Lobe Of Cam Working For Inlet Valve Is Made Circular. Also Cam Working For Exhaust Stroke With Another Lobe Opposite To Lobe Already Present Is Provided. This Ensures Opening Of Exhaust And Closing Of Inlet To Work At Charged Timing.

V. WORKING OF COMPRESSED AIR ENGINE

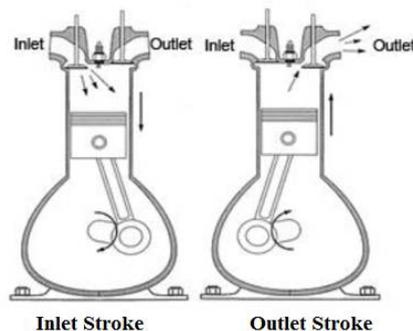


Fig: Compressed Air Engine Working

A) Compressed Air Enters Into The Cylinder From The Storage Tank The Position Of Piston Is At Tdc. Pressure Is Exerted By Air And Drive The Piston Towards Bdc Allowing Compressed Air To Expand. This Stroke Is Called Power Stroke. It Is Main Source Of Engine Power And Torque.

B) Inlet Valve Is Closed And Exhaust Valve Is Opened And The Expanded Air In The Cylinder Is Released Outside Of Cylinder. The Pressure Of Air Is More Than Atmospheric Pressure

On Comparing It With The Working Of Normal Si 4 Stroke Engine, We Can Say That:

Stage 1 Of The Air Engine Comprises Of The Combined Operation Of 'Suction Stage' And 'Power Stage' Of The Normal 4 Stroke Si Engine.

Stage 2 Of The Air Engine Comprises Of The Combined Operation Of The 'Compression stage' And 'Exhaust Stage' Of The Normal 4 stroke Si Engine.

In Comparison To Petrol Or Diesel Powered Vehicles "Air Powered Vehicles" Have Following Merits And Demerits:

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Merits

- Air, On Its Own, Is Non-Flammable, Abundant, Economical, Transportable, Storable And, Most Importantly, Nonpolluting.
- Compressed Air Technology Reduces The Cost Of Vehicle Production By About 20%, Because There Is No Need To Build A Cooling System, Fuel Tank, Spark Plugs Or Silencers.
- High Torque For Minimum Volume.
- The Mechanical Design Of The Engine Is Simpleand Robust.
- Low Manufacture And Maintenance Costs As Well As Easy Maintenance.
- Lighter Vehicles Would Mean Less Abuse On Roads, Thus, Resulting In Longer Lasting Roads.
- The Price Of Fueling Air Powered Vehicles Will Be Significantly Cheaper Than Current Fuels.
- When The Air Is Being Compressed At Reasonable Speeds, It Heats Up. The Heat Given Off During Compression Could Be Reclaimed For Space Heating Or Water Heating, Or Used In A Sterling Engine.
- Transportation Of The Fuel Would Not Be Required Due To Drawing Power Off The Electrical Grid. This Presents Significant Cost Benefits. Pollution Created During Fueltransportation Would Be Eliminated.
- Compressed-Air Vehicles Are Comparable In Many Ways Even To Electric Vehicles And Their Potential Advantages Over Electric Vehicles Include:
- Compressed-Air Vehicles Are Unconstrained By The Degradation Problems Associated With Current Batterysystems.
- 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. Compressed-Air Tankscan Be Disposed Of Or Recycled With Lesspollution Than Batteries.
- The Tank May Beable To Be Refilled More Often And In Lesstime Than Batteries Can Be Recharged, With Refueling Rates Comparable To Liquid Fuels.
- The Tanks Used In A Compressed Air Motor Have A Longer Lifespan In Comparison With Batteries, Which, After A While Suffer From A Reduction In Performance.

Demerits

- When Air Expands, As It Would In The Engine, It Cools Dramatically (Charles Law) And Must Beheated To Ambient Temperature Using A Heat Exchanger Similar To The Intercooler Used Forinternal Combustion Engines. This Might Be Problematic If The Kit Is Employed On A Full Scaleautomobile.

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- Refueling The Compressed Air Container Using A Home Or Low-End Conventional Air Compressor may Take As Long As 4 Hours (Although The Specialized Equipment At Service Stations May Fill the Tanks In Only 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 Vehicle 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.
- The Limited Storage Capacity Of The Tanks Will Severely Hinder The Distance Possible To Cover with Even A Fully Charged Cylinder.

VI. FUTURE SCOPE

Compressed Air Engine Will Be Make Revolution In Automobile Industry. This Engine Having Many Advantages Than The Conventional Engines. With Some Modifications It Will Give Better Performance than The Conventional Engines. This Engine Having Minimum Disadvantages And Cheap. So In Future compressed Air Engine Will Be Give The Better Option For The Conventional Engines

VII. CONCLUSION

On The Whole, The Technology Is Just About Modifying The Engine Of Any Regular Ic Engine Vehicle Into An Air Powered Engine. The Air Powered Engine Technology Is Cheaper In Cost And Maintenance, Can Be Easily Adapted By The Masses And It Doesn't Cause Any Kind Of Harm To The Environment. Instead, Its Widespread Use Will Help Mankind In Controlling The Serious Problem Of Global Warming.

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