PLC OPERATED AIR COMPRESSED ENGINE

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Abstract - *This paperwork deals with the Compressed-air engine with a plc system that converts one form of energy into another. The air-compressed engine is an eco-friendly engine that uses air from the atmosphere. This air can be used as an alternative source and no emission of fuel for the energy of the engine. This Engine uses the pressure of the compressed air to drive the pistons of the engine. If we compress air into a cylinder the air in it will get pressured due to the compression of the air molecule. That pressure can be used for the expansion or movement of an object. Here the word is done by the expansion or the movement of the object. So this energy can also be utilized to displace a piston. This kind of system is called a pneumatic engine. Here the compressed air is fuel and it is directly fed into the modified four-stroke engine. There is no mixing of fuel with air as there is no combustion To verify the theoretical analyses model, an experimental system is built to test the output power and efficiency of a compressed air engine with a plc system.*

Key Words: Air, Compressed, Engine, Energy, Pressure, Plc connection, Air distribution

1. INTRODUCTION

A wide variety of renewable source technologies are demanded to meet the challenges of sustainable energy development[1]. Air pollution has come to a severe problem that influences the survival and development of humankind. Because transportation accounts for a major share of global primary energy demand and exhaust from internal combustion (IC) machines contribute largely to carbon emigrations, it's critical to find indispensable energy sources for machines with clean and environmentally friendly energy carriers. Some kinds of zero-emigration vehicles have been explored considerably. The battery-electric vehicles offer high energy effectiveness, allow energy diversification, enable cargo equalization of the power system, and operate still, the heavy essence pollution, high original cost, limited battery life, and long charging time have limited their development and operation. The superiority of hydrogen energy carriers is of high energy viscosity; nonetheless, the lack of safety, energy effectiveness, and storehouse difficulties presently help the development of hydrogen-powered energy cell vehicles[2]. If we can make use of air as an aid for running a machine it's a good idea. As we all know, the air is each around us, it no way runs out, it's non-polluting and it's free. An Air operated Engine is based on Compressed Air Technology for its working[3]. Compressed Air Technology is now extensively preferred for exploration by different diligence for developing different drives for different purposes. Compressed Air Technology is relatively simple. Compressed air is an implicit clean and environmental-friendly energy carrier.

2. CONSTRUCTION

2.1 Components

A. Engine

B. Compressor

C. Solenoid valve

D. Plc connection

E. Heating element

F. Proximity sensors

G. Divergent nozzle

A. Engine

A Compressed- air engine is a curvaceous selector that creates useful work by expanding compressed air. They've been in numerous forms over the once two centuries, ranging in size from handheld turbines up to several hundred power. Some types calculate on pistons and cylinders, others use turbines. Numerous compressed air machines ameliorate their performance by heating the incoming air, or the machine itself. Some took this a stage further and burned energy in the cylinder or turbine, forming a type of internal combustion engine. One can buy a vehicle with an engine or buy an engine to be installed in the vehicle. Typical air machines use one or further expander pistons. In some operations, it's profitable to toast the air, or the machine, to increase the range of power.

B. Compressor

An air compressor is a device that converts power into potential energy by forcing it into a smaller volume and thus increasing its pressure. When the stored compressed air is released freely it expands thereby releasing the energy that can provide useful work. The compression, storage, and release of the air together are termed Compressed Air Technology. Compressed air is regarded as the fourth account.

C. Solenoid valve

solenoid valve is an electromechanically operated valve. It is controlled by a program in the plc control unit. This valve is used to control the flow of air is positive, when fully closed or fully open mode. This valve has two ports. The one port of the valve is connected to the pneumatic cylinder and the other port is connected to the mainline. When the coil is energized a magnetic field is produced and raising the plunger for allowing flow through the valve to operate the pneumatic cylinder.

D. Plc circuit

It is a pre-programmable device. It is used to control the solenoid valve for the flow of the pressured air in it. The sensor gives the input signal to the PLC. When the PLC output controls the valve and makes the work done.

E .Heating element

The compressed air is heated in a.c supply with the support of nichrome wire. The heating coils are winded in the tube. In this set up the air is heating and it expands go to the engine. It is measured in temperature sensor and controlled.

F. Proximity sensors

A proximity sensor is a device able to detect the presence of nearby objects with any physical contact. It often emits an electromagnetic field or electromagnetic radiation and looks for changes in the return signal. The maximum distance that this sensor can sense is defined as the nominal range. Here, the proximity sensor detection distance is 4mm. It is fitted in the head of the engine.
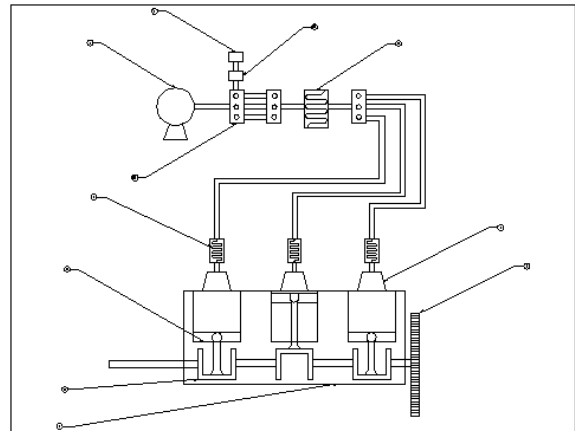
2.2 Specification of parts

SI NO	Description	Specifications
1	Maruthi 800 engine	2 valve,3 cylinder
2	Compressor	Max 300bar
3	Solenoid valve	required
4	proximity sensor	RM12 DC6~36V
5	Nozzle set up	Divergent
6	Heating setup	Length – 20cm Breadth -15cm

2.3 Diagram

The following diagram shows the elevation of Air operated four stroke engine.

1.compressor
2.solenoid valve
3.plc circuit
4.heating setup
5.divergent nozzle
6.fly wheel
7.engine

3. WORKING

First of all the compressed air is going to the engine by using the compressor. By using a proximity sensor the engine has to sense the top dead center. The proximity sensor is fixed at the cylinder head so that it can sense easily. The sensor sends the output signal to PLC. Programmable Logic Control progresses the signal according to the program which was fed to PLC. The PLC output is sent to the solenoid valve. After receiving the signal from the PLC solenoid valve allows the compressed air goes for heating coils. When air is heated and it expands to go with the hose to nozzle setup. And it is pressurized it goes to cylinder.

3.1 Power stroke

In the power stroke the compressed air heated sent pressurized to the cylinder to displace the piston, the air pressure required to move the piston is calculated by the indicated power produced in an actual power stroke,
For calculating indicated power,

(indicated power) **IP = K Pm L A n / 60 KW**
Where,

     K - *no. of cylinders,*
     L - *length of stroke,*
     A – *cross section area of piston(m^2) =>($\pi d^2/4$),*
d – cylinder bore,
     Pm – *mean effective pressure(kN/m^2),*
     n - *no. of working stroke per minute => N for a 2 stroke cycle, N – engine speed(rpm).*

     The power produced from the ignition power stroke is noted in KW, then converting KW into HP '1 KW = 1.341 HP',
As we know,

  (horsepower) **HP=F*d / t**

 Where,

     F – *force in pounds,*

     d – *distance in feet,*
     t – *time in minutes,*

  *For calculating force(**F**=pressure*area),*

     Hp= pressure*area*d / t,

Then,

     Pressure= Hp*t / area*d,

     The pressure in it is calculated and the stroke of piston is controlled by plc unit.

3.2 Exhaust stroke

     In the exhaust stroke the air compressed which is used to displace the piston is taken out by just opening the exhaust valve. The upward motion of the piston pushes the air out through the valve.

4. CONCLUSION

     Currently, the need for energy continuously increases and we're using the conventional resources hence alternative energy is much required and this technology can be the best option, as the pollution caused is zero and it's also cost-effective.

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