Development of Free Energy, Eco-Friendly, Two-Stroke Engine

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Abstract

The most recent trend in the vehicle industry is to manufacture light-duty vehicles which are efficient for short-distance transportation. Therefore, many automotive industries are working to reduce the weight of vehicles which helps to better handle vehicles and provide maximum efficiency. Nowadays, most of the vehicles run on fossil fuel which is very harmful to the environment due to the high production of pollution as well as increasing cost because of decreasing the sources of fossil fuels. Considering such issues, many researchers are working on alternative sources which are easy to fabricate, maintain and eco-friendly. In this study, an air-driven engine is designed and fabricated. A single-cylinder Honda engine is used for the experiment. From the results, it is found that the operating pressure to run the engine ranges from 2-10 bar and the speed of the engine without load ranges from 600-800 Rpm. The torque and power obtained at the different loads are 3.32 N.m and 217.24 W, respectively. The obtained power output of the engine is enough to drive a small a lightweight vehicle such as a club car.

Keywords—Internal combustion engine, air-driven engine, lightweight vehicle, solenoid valve, Arduino.

1 Introduction

In the last couple of decades, vitality preservation and increasing carbon in the environment have emerged as one of the most critical issues. For this reason, researchers have been looking for answers to decrease carbon dioxide discharge and enhance fuel utilization. Under these conditions, researchers have been likewise endeavoring to discover elective vitality sources [1][2]. Compressed air is the one which is at more than atmospheric pressure. It fills numerous household and mechanical needs [3]. Compressed air utilization in the pneumatic application has been illustrated for quite a while. Air motors, pneumatics actuators and such distinctive pneumatics kinds of apparatus are being utilized [4]. The compressed air engine is the engine that runs on the compressed air rather than the air-fuel blend consumed in the barrel to drive the cylinder by extension waste gases [5]. Lamentably manufacturing of compressed air exclusively for the pneumatic vehicle is not moderate yet in manufacturing industries. Compressed air is widely utilized for some applications, for example, cooling, drying, activating and evacuation metal chips. Moreover, as a type of vitality, compressed air contains no fire or explosion hazards. As the most common substances, it is perfectly safe and viewed as thoroughly green [6]. Endeavors are being made by numerous designers and makers to ace the compressed air vehicle innovation in all regards for its use by humanity [7]. In a recent study, a 4-stroke motor was adjusted into a 3-stroke motor and was utilized to keep running on compressed air innovation. Some test was performed on the altered motor to contemplate the viability of the motor [8]. As of now, a few organizations have begun to create compressed air. A vehicle still has numerous favorable circumstances and genuine bottlenecks to handle. This quickly condenses the rule of innovation, most recent advancement, preferences, and issues in utilizing compressed air as a wellspring of vitality to run vehicles [9]. The research was tested to advance the air driven engine by modification of traditional spark plug engine into an air driven engine. The expenditure inquiry was calculated which shows the compressed air engine becomes cheaper as compared to the traditional spark plug engine [10].

2 Working Principle

The compressed air innovation is trivial if we tend to compress traditional air into a cylinder. The air will

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hold some energy at the interim which can be used as an invaluable function. At the point, when this compressed air expands, the energy is discharged to do work. Therefore, this vitality in compressed can likewise be used to move the piston. This can be the fundamental regulation of the air driven engine. Hence, an air-driven engine is essentially a pneumatic actuator that makes helpful work by expanding compressed air. The work done by air is employed to provide power to the rotating shaft of the engine. On account of the air-driven engine, there is no burning occurring inside the engine. Therefore, it is non-contamination and safer. It requires lighter metal since it does not need to withstand higher temperatures, as there is no ignition fuel and air. Here compacted air is the fuel and it is fed directly in the cylinder. It essentially extends inside cylinder and does helpful work in the cylinder. This work done on the cylinder gives adequate capacity to the crankshaft.

3 Methods & Materials

In this study, a single-cylinder 118 cubic centimeter (cc) Honda engine was used. The piston-cylinder was needed as an outlet and an exhaust in this research. However, a typical four-stroke engine has few ports and it additionally has the spark plug which was not required. Therefore, few alterations were done on the engine, for example, removing the petrol valve mechanism, shutting the inlet valve, and expelling the start plug from the cylinder head, etc. The spark plug is replaced by an inlet and given an appropriate connector at the head of the cylinder. It was required to seal the inlet port so that the air cannot get away. The automatic mechanical decompression system was removed so that inlet port remains closed. The exhaust port stays unaltered because as the piston is displaced from Bottom Dead Centre (BDC) to Top Dead Centre (TDC), the exhaust port opens and air gets discharged. The existing recycled engine is shown in Figure 1.

As only air flows in the inlet, therefore, there was no hazard of an explosion in the cylinder. Hence, no need for the spark plug arised and the start plug was expelled from its particular position. It is not possible that the entry of the compressed air replaces the spark plug as it is smarter to give air from the top of the cylinder. Therefore, the connector which is utilized to attach the pipe with a compressed air tank, must be settled at the place of the start plug. The connector has the same sized thread as on the spark plug.

For the valve actuation system, a valve disc was needed to show the piston position in the cylinder. The disc

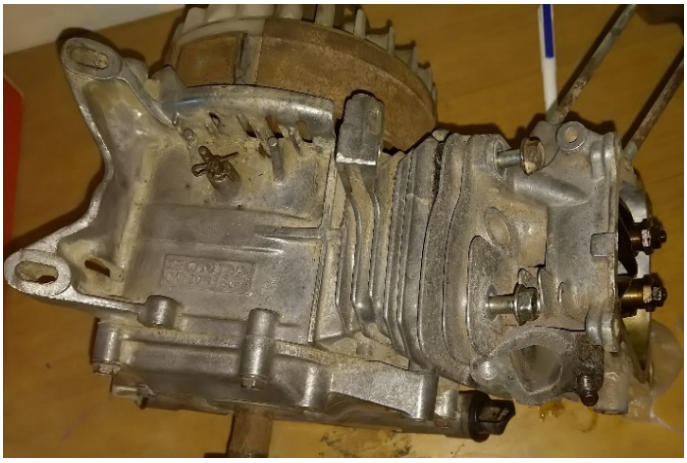

Fig. 1: Recycled existing two-stroke engine

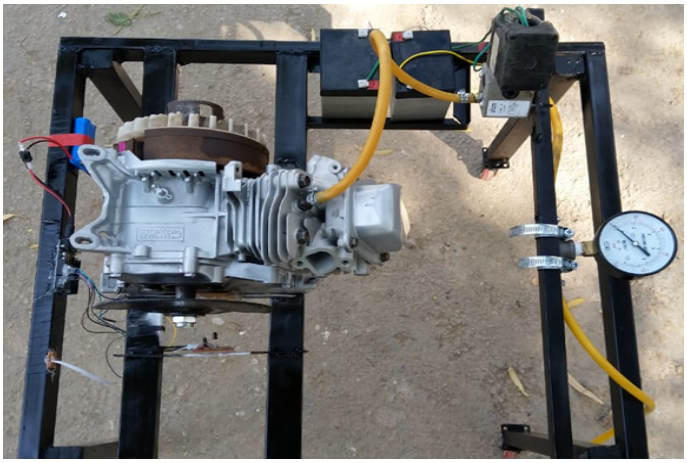

Fig. 2: Two-stroke air engine model

was cut out in some portion according to the piston position. A hacksaw was used to cut the desired portion of the disc. The mechanism of the valve was handled by a valve actuation system. The finished model of the 2-stroke engine is shown in Figure 2.

The valve used in the experiments was a 3/2 solenoid valve. This valve is a constantly closing valve and works only at a high voltage. Initially, a voltage of 24 v is supplied to the circuit. The circuit supplies the high voltage to the valve and the valve gets open. The circuit diagram for air-driven engine (as shown in Figure 3, consist of an Arduino Uno, Solenoid Valve, IR pair, transistor, resisters, batteries and switches). The power supplied by the 7-volt battery to the Arduino Uno and Arduino Uno takes 5 volts for itself. Since each part in this circuit works only on 5 volts, all the components are given 5 volts by the circuit. The emitter and collector were given a resister of 470 ohms and 10000 ohms respectively in series to further lower the voltage. The transistor works as a switch. The 24

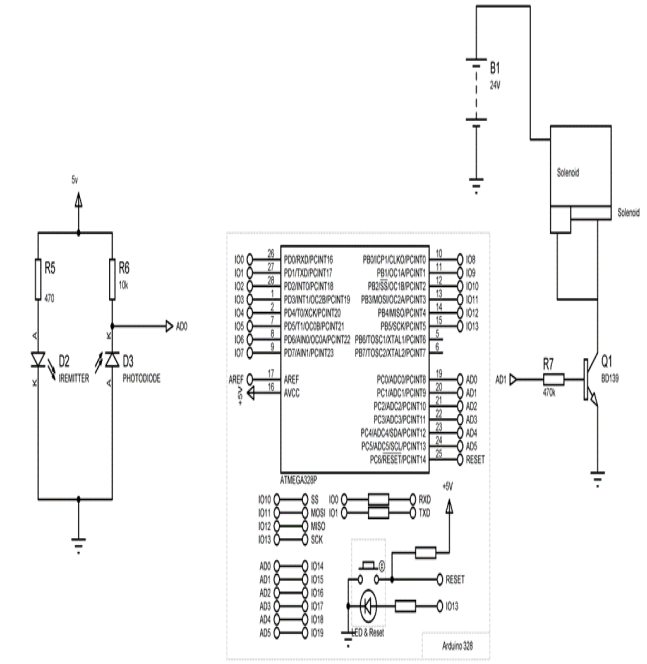

Fig. 3: Circuit diagram of the Valve Actuation system

```
project_coding1
void setup() {
  pinMode(A0,INPUT);
pinMode(A1,OUTPUT);
Serial.begin(9600);
}

void loop() {
int a=digitalRead(A0);
Serial.println(a);
if(a==0){
  digitalWrite(A1,LOW);
  Serial.println("off");
}
else{
  digitalWrite(A1,HIGH);
  Serial.println("on");
}
}
```

Fig. 4: Arduino Coding for Valve Actuation System

volts supplied to the solenoid valve is shown in the Figure 4.

4 Results & Discussion

The methodology discussed in section 2 has been used to design the air driven engine. This paper shows the testing of the modified engine. The hypothetical idea shows the practical usefulness of the air-driven engine as the exploratory test was conducted on the air driven engine. The altered engine was tested by using a tachometer and dynamometer apparatus at different values of compressed air pressure. The testing of the engine was carried out to measure the speed, torque, and power produced by the engine shaft. The

Fig. 5: Power Testing Apparatus

SNO.	Pressure (bar)	Speed(rpm)
1	3	616
2	4	670
3	5	688
4	6	700
5	7	732

TABLE 1: Speed of Engine at different pressure

measurement of the speed of the engine at the freeload condition is shown in Table 1. After the measurement of the speed of the engine, it was observed that the speed of the engine depended on the pressure of the engine. Figure 6 shows the relationship between pressure and speed. Before the measurement of torque and power of the air-driven engine, it was necessary to obtain the speed of the engine at different pressure and different loads. A dynamometer apparatus was installed to calculate the various values of speed at different pressure and load. The readings obtained by a dynamometer are shown in Table 2 - Table 7. Different loads were applied to the air driven engine,

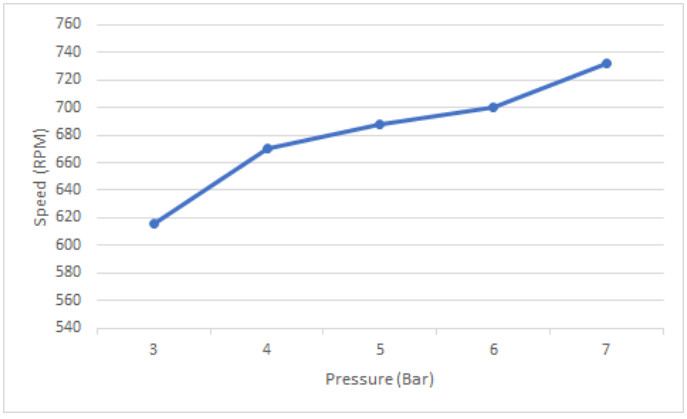

Fig. 6: Power Testing Apparatus

S. No.	Pressure (bar)	Speed(rpm)
1	3	616
2	4	670
3	5	688
4	6	700
5	7	732

TABLE 2: Speed of engine at no-load condition

S. No.	Pressure (bar)	Speed(rpm)
1	3	590
2	4	636
3	5	651
4	6	675
5	7	703

TABLE 3: Speed of Engine at 0.5 Kg load condition

S. No.	Pressure (bar)	Speed(rpm)
1	3	572
2	4	626
3	5	640
4	6	647
5	7	672

TABLE 4: Speed of Engine at 1.0 load condition

S. No.	Pressure (bar)	Speed(rpm)
1	3	541
2	4	586
3	5	616
4	6	626
5	7	656

TABLE 5: Speed of Engine at 1.5 load conditions

S. No.	Pressure (bar)	Speed(rpm)
1	3	534
2	4	571
3	5	600
4	6	617
5	7	647

TABLE 6: Speed of Engine at 2.0 load condition.

S. No.	Pressure (bar)	Speed(rpm)
1	3	472
2	4	518
3	5	550
4	6	587
5	7	623

TABLE 7: Speed of Engine at 2.5 load condition

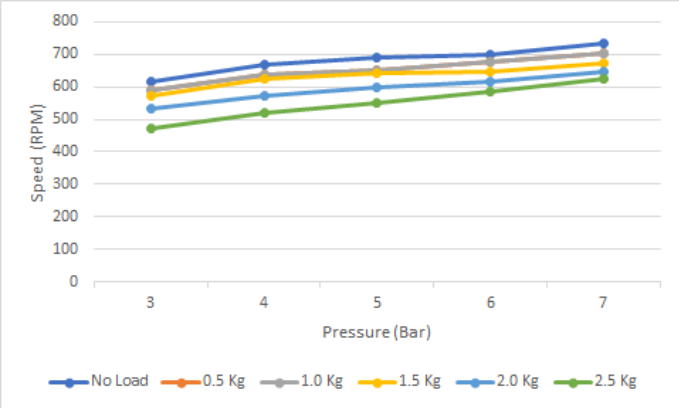

Fig. 7: Graph shows detected speed at different pressures and Load

i.e., 0.5 Kg, 1.0 Kg, 1.5 Kg, 2.0 Kg and 2.5 Kg at different pressures, i.e., 3 bars, 4 bars, 5 bars, 6 bars, and 7 bars to achieve desired level of speed. It was observed that there was an average 26 Rpm reduction in speed by at each 0.5 Kilogram increase in the load. After getting the data from dynamometer, some calculations were required to obtain the torque and power of the engine. After calculations, the following values of torque and power were obtained.

5 Conclusion

The air-driven engine gives a workable technique to produce power and transmission. From the results, it was observed that the engine runs at 600-800 RPM at the pressure of 3-7 bar, which shows that engine speed was directly proportional to the pressure of air supplied to the engine. Whereas, with the same pressure of the supplied air, the engine produced a torque of 3.32 N.m and a power of 217.24 W.
We investigated the potential of changing the standard ignition engine into an air-driven engine. The compressed air fueled engine development is less expensive in maintenance and is easily adapted by the masses. The compressed air vehicles is a viable option that gives the most thorough reaction to the present urban sullying issues. The temperature of the fumes gases is less than the air temperature and they do not cause an unnatural weather change in contrast to the traditional engine. In this way, these vehicles are expected to be safe to utilize, safe to clients and environment cordial. This investigation additionally presents an outline of the proposed future advancement of engine for making it progressively productive for open use.

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