PNEUMATIC POWER GENERATION

Ashitosh Tarade
UG student, Dept. of mechanical engineering,
SKNSIT lonavala, Pune, India.
ashitoshta@gmail.com

Ravindra Sondekar
UG student, Dept. of mechanical engineering,
SKNSIT lonavala, Pune, India.
ravindrasondekar@gmail.com

Sudhir Jogdand
UG student, Dept. of mechanical engineering,
SKNSIT lonavala, Pune, India.
svjogdand95@gmail.com

Nitesh Bhalerao
UG student, Dept. of mechanical engineering,
SKNSIT lonavala, Pune, India.
nitnikraj@gmail.com

Abstract: *In this project we are generating electrical power as non-conventional method by pneumatic cylinder and slider crank mechanism. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy by pneumatic cylinder is converting mechanical energy into the electrical energy. This project using simple drive mechanism such as assemble slider crank mechanism for this project the conversion of the force energy in to electrical energy. The control mechanism carries the pneumatic cylinder, wheel, D.C generator, battery and an inverter control. We have discussed the various applications and further extension also. The D.C generator used in this project is Permanente Magnet D.C generator. The Generator is coupled to the fly wheel Shaft with the help of Spur Gear Mechanism.*

Keywords: Non-conventional, Slider crank mechanism, Pneumatic cylinder.

---

1. INTRODUCTION

Man has needed and used energy at an increasing rate for his sustenance and well-being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. So He derived energy by eating plants or animals. Subsequently he discovered fire and his energy needs augmented as he started to make use of wood and other bio mass to fulfil the energy needs for cooking as well as for keeping himself warm.

With the span of time, man started to cultivate land for agriculture. He always found a new dimension to the use of energy by domesticating and training animals to work for him. With further increasing demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Along with that the sun was supplying all the energy needs of man either directly or indirectly. The man was using only renewable sources of energy.

2. LITERATURE REVIEW

1. Study of a Pneumatic-Electrical System for Exhaust Air Energy Recovery Xing Authors: Luo, Jihong Wang, Hao Sun

Compressed air, as a relatively clean and low-cost energy source, has been widely used in many application areas, especially in industry to generate driving forces for motions. From the statistics of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, in U.S., air compressors typically consume around 20% of electricity in manufacturing factories. The whole system can be considered to have several parts, as explained below: 1) existing pneumatic actuator system: it serves as a simulation for actual industrial situations to produce the exhaust from pneumatic actuator(s), which is also named up-stream subsystem. This part consists of the air supply, the existing pneumatic actuator(s) and the main load(s). 2) Exhaust air energy recovery system: in this part, the exhaust air energy recycled

by the scroll-type air motor converts to the electrical energy via the generator operation. The part is named down-stream subsystem in the paper as well. It includes an air tank, an AC generator with its electric load and a scroll air motor. Employing an intermediate air tank is for weakening the negative effect from the down-stream to the up-stream and also for the control strategy implement. 3) Controller: a proper controller is designed for supporting the whole system operation. The controller manages the air pressure and the air flow at the up-stream and the down-stream.

2. A Miniature Pneumatic Energy Generator Using Kármán Vortex Street Hai-Dang

Author: Tam Nguyen1, Huy-Tuan Pham2 and Dung-An Wang

A proof-of-concept of a miniature pneumatic energy generator for harnessing energy from Kármán Vortex Street behind bluff bodies is presented. It converts flow energy into electrical energy by piezoelectric conversion with oscillation of a piezoelectric film. The tandem arrangement of the bluff bodies is designed to enhance the amplitude of the pressure fluctuation in the vortex street, which vibrates the piezoelectric film. Prototypes of the energy generator are fabricated and tested. Experimental results show that an open circuit output voltage of 14 mVp and an average output power of 0.59 nW are generated when the pressure oscillates with an amplitude of nearly 70 Pa and a frequency of about 872 Hz. This energy harvesting approach has the potential of converting the flow energy of compressed air in a pipeline into electricity for powering wireless sensing devices. Future design guidelines for increasing the electrical power output are suggested based on analyses.

3. Nutrient Removal Potentials of varied Aquatic Plants.

Author: K. K. Steward

Nutrient enrichment of natural waters succeeding from man's activities has been powerfully involved as a heavy rationalization for nuisance growth of aquatic plants. Fifteen chemical nutrient elements square measure recognized as requirements for ancient plants growth and development. substance and element levels, however, square measure generally the limiting factors for aquatic plants growth since gift concentrations of the remaining elements square measure seldom low enough to be growth limiting. The quantities of nutrients that square measure most likely removable by varied aquatic plants are calculated from yield and mineral composition information.

4. Electrical Power Generation from Non-Continuous Flow in a Self-contained Breathing Apparatus

Authors: Matthew James Palamara

The purpose of this research was to investigate alternate methods for powering the electrical functions of an SCBA (self-contained breathing apparatus). Replacing the batteries with a self-sufficient source of constant power is attractive for its characteristics of both reliability and cost efficiency. Maintenance of charged batteries and the logistics difficulty of a SCBA arriving at the scene are not able to operate and create an environment which is potentially quite dangerous and certainly unreliable. By depending on a maintenance-free, constant source of power, the jobs of fire departments could be made easier, and the lives of firefighters safer. Different types of method were considered for the ground-up design, but selected was the concept of an inline unit comprised of a small DC dynamo coupled with a pneumatic motor. The generator would be drive by the air flow resulting from each inhalation breath. Different tests were performed to prove the generator's capability in both sufficient continuous power generation and in its implementation without affecting the existing performance of the SCBA. An accumulator was installed to the system as a corrective method to keep the internal mask pressure at an acceptable level. The final design of the power generation cell includes a non-reversible air motor, coupled with the appropriate DC motor, contained within a sealed cell which acts as an accumulator, and a leak containment for the unit as protective enclosure. The unit is self-contained, IV easily added to an SCBA, and has no negative effects on the current design of the system. Sufficient levels of continuous power were reached, ranging from 4 to 7 Watts depending on the rate of breathing.

5. Output of Electric Power from Pneumatic Wave Power Generation System with Water Valve Rectifier

Authors: Keiichi Ueki, Kiyofumi Ishizawa, Hiroyuki Nakagawa

Electric output characteristics of a new wave power conversion system are discussed. In this system, water valves, not mechanically operated, are combined with air chambers. The advantage of this system is that the rectifying water valves, with no moving parts, suffer less frequent failures. The demonstration test for practical use has been carrying out at Haramachi site since "96. The test plant consists of four air chambers, four water valve chambers, and one turbine generator and so on. Air chambers are about 40m in length, 24m in

breadth and 24m in height. The electricity, 130kW in specifications, is transmitted to the distribution line. In the demonstration test, we are measuring wave height, pressure in air chambers, water valve chambers and turbine room, electric output and so on. We obtained over 100 time series data from "96 to "98 on condition that the submerged depth of water valve is 10cm. In this paper, typical electric output data are shown and the relationships between sea condition and averaged or fluctuating electric output are discussed. We are planning to change the submerged depth of water valves and number of air chambers in the next phase of demonstration test.

3. CONSTRUCTION

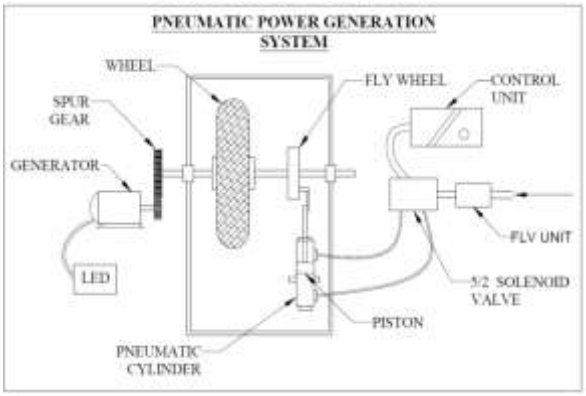

Figure.1 Schematic diagram of pneumatic power generation.

Components of the system:

1. Base frame: By standard available sizes we select the 1 inch = 25.4 mm so because that will be easily available and have appropriate size for frame.
2. Shaft.
3. Bearings: for low friction between rotating elements in contact with each other.
4. Pneumatic actuator.
5. Flywheel: flywheel is used to increase inertia force.
6. Solenoid DC valve: To maintain proper direction of compressed air.
7. DC motor: DC motor is used as generator.
8. Hoses and valve connectors: used to transport compressed air.
9. GEAR: To transmit motion.

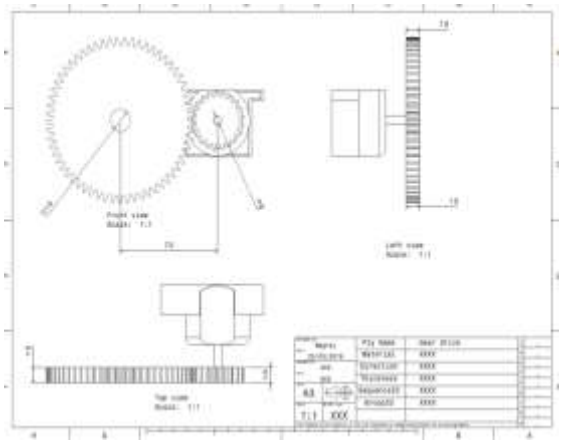

Figure.2 Spur Gear

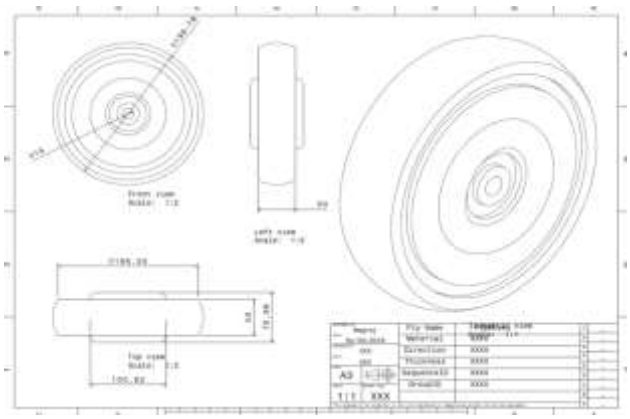

Figure.3 Wheel design

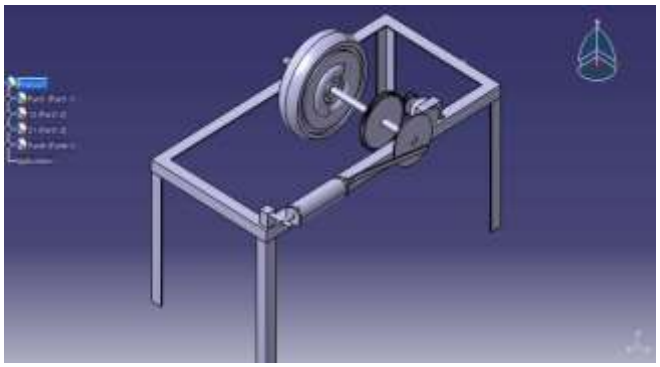

Figure.4 Actual model of pneumatic power generation

4. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

ADVANTAGES

I. Power generation is simply using compressed air.

II. No need fuel input.

III. This is a Non-conventional system.

IV. Battery is used to store the generated power.

DISADVANTAGES

I. Only applicable for the particular place.

II. Mechanical moving parts are high**.**

III. Initial cost of this arrangement is high.

IV. Care should be taken for batteries

APPLICATIONS

I. Pneumatic power generation is Large or some small scale Industries.

5. CONCLUSION:

In this project we are generating electrical power as non-conventional method by pneumatic cylinder and slider crank mechanism. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy by pneumatic cylinder is **converting mechanical energy into the electrical energy.** This project using simple drive mechanism such as assembles slider crank mechanism.

Our project has very important scope in industries and workshops where the use of compressed air and its wastage is taking place.

It is very efficient and profitable to regenerate electrical energy from waste or stored compressed air.

I. In industrial units where lots of waste of compressed air.

In spray painting and car cleaning workshops.

II. In big air conditioning or big refrigeration plants where lot of compressed air is produced and not been used perfectly.

6. ACKNOWLEDGEMENT

We might wish to convey the analysts and conjointly distributers for creating their assets accessible. We have a tendency to in addition appreciative to commentator for his or her vital recommendations what is more conveying the varsity powers for giving the obligated base and backing.

7. REFERANCE

[1] Xing Luo, Jihong Wang, Hao, “Sun Study of a Pneumatic-electrical System for Exhaust Air Energy Recovery”, International Journal of Energy Engineering (IJEE) Dec. 2013, Vol. 3 Iss. 6, PP. 228-238.

[2] Noaman Makki and Remon Pop-Iliev, “Piezoelectric Power Generation In Automotive Tires”, SMART MATERIALS, STRUCTURES & NDT in AEROSPACE Conference NDT in Canada 2011 2 - 4 November 2011, Montreal, Quebec, Canada.

[3] Hai-Dang Tam Nguyen, Huy-Tuan Pham and Dung-An Wang, “A miniature pneumatic energy generator using Kármán vortex street”.

[4] Matthew James Palamara, “Electrical Power Generation from Non-Continuous Flow In A Selfcontained Breathing Apparatus” University of Pittsburgh 2004.

[5] Keiichi Ueki, Kiyofumi Ishizawa Hiroyuki Nakagawa, “Output of Electric Power From Pneumatic Wave Power Generation System With Water Valve Rectifier” The Tenth International Offshore and Polar Engineering Conference, 28 May-2 June, 2000, Seattle, Washington, USA.

[6] José A. Riofrio and Eric J. Barth, “A Free Piston Compressor as A Pneumatic Mobile Robot Power Supply: Design, Characterization and Experimental Operation”, International Journal of Fluid Power 8 (2007) No. 1 pp. 17-28.

[7] Sylvain Lemofouet, Alfred Rufer, “Hybrid Energy Storage System based on Compressed Air and Super Capacitors with MEPT (Maximum Efficiency Point Tracking)”, The 2005 Power electronics conference.

[8] Young Min Ki, “Novel concepts of compressed air energy storage and thermo-electric energy storage”.

March 2017