

POWER GENERATION FROM KINETIC ENERGY OF EXHAUST GASES

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Abstract - There are many innovative methods for generating electricity. This project defines how we can generate electricity using exhaust gas. The turbine and dynamometer are used in this project. Dynamo is connected to the turbine which is used to generate power. The turbine is placed in the exhaust path of the silencer. The generated power differs, depending upon the airflow in the exhaust path. The dynamo starts to rotate using turbine and converts kinetic energy into electrical energy. The battery stores the generated power. The voltage has to be inverted, to be used in the equipments. We can use the stored power depending upon our comfort

Key Words: Turbine, Dynamo, Generator, Battery

1. INTRODUCTION

Over the last couple of decades, mankind has realized that the continuous usage of petroleum fuels to meet the world's energy demand, over the course of more than a century, has led to innumerable consequences. An inclination towards other sources for energy has come into the forefront. Yet, we are still a long way from completely phasing out petroleum as an energy source altogether. In such a time, any progress towards reducing the amount of fuel consumed during energy generation is good progress and cannot be neglected. In recent years the scientific and public awareness on environmental and energy issues has brought in major interests to the research of advanced technologies particularly in highly efficient internal combustion engines. Viewing from the socioeconomic perspective, as the level of energy consumption is directly proportional to the economic development and total number of population in a country, the growing rate of population in the world today indicates that the energy demand is likely to increase. Only 30 to 40% of total energy produced in an engine is utilized to run the vehicle and engine accessories. The rest is wasted in the form of exhaust heat and noise. So, there is a scope for reclaiming the wasted power produced by the engine. Various methods to reduce the wastage of energy from automobile engines have been put forth. These include thermoelectric generators (TEG), Organic Rankin cycle (ORC), six-stroke cycle IC engine and new developments on turbocharger technology. Among many methods, turbine-based power generation through the exhaust gases has proven to be an efficient source

of energy generation. Turbine Based Power Generation works on the principle of conversion of kinetic energy into electric energy. In this process, a turbine is fixed near the opening of the silencer. A dynamo is attached to the turbine, which converts kinetic energy generated through the turbine into useful electrical energy. This electric energy can be further utilized in a stored form with the help of a battery or can be utilized to run an electrical accessory on the vehicle.

2. HARDWARE DESCRIPTION

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in figure.

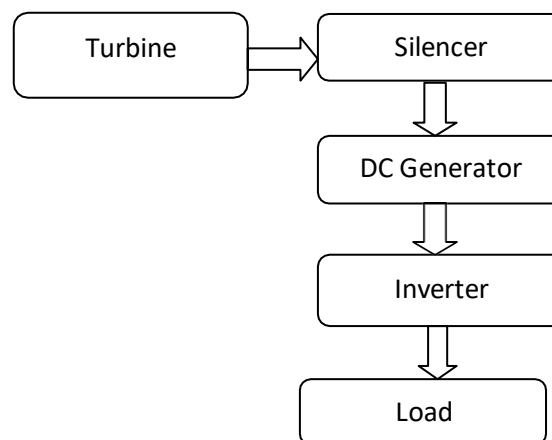


Fig 1: block diagram.

MOTOR AS GENERATOR

Before the connection between magnetism and electricity was discovered, electrostatic generators were used. They operated on electrostatic principles. Such generators generated very high voltage and low current. They operated by using moving electrically charged belts, plates and disks that carried charge to high potential electrode. The charge was generated using either of two mechanisms.

- Electrostatic induction
- The turboelectric effect, where the contact between two insulators leaves them charged.

A motor-generator (an M-G set or a dynamo at from dynamo-motor) is a device for converting electric power to another form. Motor generator set are used to convert frequency, voltage or phase of power. They may also be used to isolate electrical loads from the electrical power supply line. Low-powered device such as vacuum tube mobile radio receives did not use motor generated. Instead, they are typically used an inverter circuit consisting of vibrator (a self-exciting relay) and a transformer to produce the B+ voltages require from vacuum tube. While a motor generator set may consist of distinct motor and generator machines coupled together a single unit motor-generator will may both rotor coils of the motor and the generator would around the single rotor and both coil shares the same outer field coils are magnet.

Typically the motor coils are driven from a commutator on one end of the shaft, when the generator coils output to another commutator on the other end of the shaft. The entire rotor and shaft assembly is smaller in size than a pair of machines, and may not have any exposed drive shafts. In electricity generation, an electric generator is a device that converts mechanical energy to electrical energy. A generator forces electric current to flow through an external circuit. The source of mechanical energy may be a reciprocating or turbine steam engine, water falling through a turbine or waterwheel, an internal combustion engine, a wind turbine, a hand crank, compressed air, or any other source of mechanical energy. Generators provide nearly all of the power for electric power grids.

ELECTROMAGNETIC GENERATOR DYNAMO

A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. Today, the simpler alternator dominates large scale power generation, for efficiency, reliability and cost reasons. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economic.

ALTERNATOR

Without a commutator, a dynamo becomes an alternator, which is a synchronous single fed generator. Alternators

produce alternating current with a frequency that is based on the rotational speed of the rotor and the number of magnetic poles. Automotive alternators produce a varying frequency that changes with engine speed, which is then converted by a rectifier to DC. By comparison, alternators used to feed an electric power grid are generally operated at a speed very close to a specific frequency, for the benefit of AC devices that regulate their speed and performance based on grid frequency. Some devices such as incandescent lamps and ballast-operated fluorescent lamps do not require a constant frequency, but synchronous motors such as in electric wall clocks do require a constant grid frequency.

OUTPUT OF THE DYNAMO

- Output Voltage : 6-12 V
- Output Current : 0.5 A
- Output Power : 3-6

SILENCER

A muffler is a device for reducing the amount of noise emitted by the exhaust of an internal combustion engine. Mufflers are installed within the exhaust system of most internal combustion engines, although the muffler is not designed to serve any primary exhaust function. The muffler is engineered as an acoustic soundproofing device designed to reduce the loudness of the sound pressure created by the engine by way of Acoustic quieting. The majority of the sound pressure produced by the engine is emanated out of the vehicle using the same piping used by the silent exhaust gases absorbed by a series of passages and chambers lined with roving fiber glass resonating chambers harmonically tuned to cause destructive interference wherein opposite sound waves cancel each other out. An unavoidable side effect of muffler use is an increase of back pressure which decreases engine efficiency. This is because the engine exhaust must share the same complex exit pathway built inside the muffler as the sound pressure that the muffler is designed to mitigate.

COMPONENTS THAT INFLUENCE AIRFLOW OUT OF THE ENGINE ARE

Exhaust valve and exhaust ports of the cylinder head

Camshaft

Exhaust manifolds

Turbo's turbine (if applicable)

Exhaust tubing catalytic converters

Muffler

When these components are modified to increase flow out of the engine, pumping losses are reduced. Pumping losses refer to the amount of horsepower (HP) used to push the exhaust gases out of the cylinders on the engine's exhaust stroke. Since less HP is used to get the exhaust out of the engine, more horsepower is available at the flywheel. An added benefit of reducing pumping losses is that fuel mileage will also increase. No matter how much additional air is forced into the engine, no additional HP will be made unless additional fuel is also added. The energy that makes HP in an engine comes from the combustion of the fuel, not only the air. In general, every two HP produced requires one pound of fuel per hour. The combustion of the additional fuel is what translates into additional HP.

WIND TURBINE

A wind turbine is a device that converts kinetic energy from the wind, also called wind energy, into mechanical energy; a process known as wind power. If the mechanical energy is used to produce electricity, the device may be called a wind turbine or wind power plant. If the mechanical energy is used to drive machinery, such as for grinding grain or pumping water, the device is called a windmill or wind pump. Similarly, it may be referred to as a wind charger when used for charging batteries. The result of over a millennium of windmill development and modern engineering, today's wind turbines are manufactured in a wide range of vertical and horizontal axis types. The smallest turbines are used for applications such as battery charging or auxiliary power on boats; while large grid-connected arrays of turbines are becoming an increasingly important source of wind power-produced commercial electricity.

RECHARGEABLE BATTERY

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes

and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead-acid, nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer).

CONCLUSIONS

Power Generation Using Exhaust Gases is mainly intended to design a silencer based energy generation system based inverter. Air blowers generally use centrifugal force to propel air forward. Inside a centrifugal air blower is a wheel with small blades on the circumference and a casing to direct the flow of air into the centre of the wheel and out toward the edge. The design of the blades will affect how the air is propelled and how efficient the air blower is. The paper makes use of a Silencer Setup, turbine and DC Generator. The energy obtained is stored to a battery. The battery supply is fed to pulse generator and in turn to a MOSFET which is capable of generating ON/OFF pulses of different frequencies. This is fed to a step up transformer to generate a low voltage AC. This AC is fed to electrical appliance.

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