

# Combination of Electromagnetic Engine and IC Engine in a Vehicle

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**Abstract:-** This paper deals with use of both electromagnetic engine and IC engine to produce power by consuming less fuel power as compare to individual IC engine. Also the heat output from IC engine's exhaust system is less. Percentage of pollution is also reduced.

**Key Words:** Waste heat recovery, TEG elements (thermo electric generator, electromagnetic engine in combination with IC engine, etc.

## 1. INTRODUCTION

IC engine makes use of fossil fuels such as Petrol, Diesel which are non-renewable sources of energy. So due to use of fossil fuels there is rise in pollution level. To avoid this pollution there is need to find an alternative which is pollution free. There are many alternative for pollution free vehicle one of them is electromagnetic engine. And we can also use waste heat from IC engine to drive the electromagnetic engine. In short we can use both IC engine and electromagnetic engine to power the same vehicle. Due to demand of fossil fuels cost of fuel rises up. So there will be a need of switching to alternative.

### 1.1 IC Engine

An Internal Combustion Engine (IC engine) is a heat engine which uses a power from a burning fossil fuel to drive a vehicle.

### 1.2 Electromagnetic engine

Magnetism is the basic principle of working for an electromagnetic piston engine. The general property of magnet i.e. attraction and repulsion forces is converted into mechanical work. A magnet has two poles. A north pole and a south pole. When like poles are brought near each other they repel and attract when like poles are brought together. This principle is being used in the electromagnetic engine. In electromagnetic engine the two poles which are excited by electric current plays an important role in producing power because the power generated by the engine depends on how much is the supply of current is in the winding. We can increase the magnetic force by increasing the winding coils. This is the working principle of electromagnetic engine.

## 2. Working of Electromagnetic engine

In electromagnetic engine, current is supplied to the electromagnets placed at the two extreme corners of the cylinder. The windings coils are kept more in number to take advantage of maximum magnetic force by the application of small current. When one electromagnet is excited, the piston which is made from permanent magnet performs

reciprocating motion. Due to the formation of unlike poles, attraction phenomenon takes place. At the same time, polarity is reversed and there is formation of like poles which will repel the piston. When piston moves from TDC to BDC upper electromagnetic pole should repel the piston and lower electromagnet should attract the piston. When piston moves from BDC to TDC, polarity is reversed. This causes lower electromagnet to repel and upper electromagnet to attract the piston.

The Piston is able to perform reciprocating motion inside the cylinder. The material used for cylindrical walls between two electromagnets is Yttrium barium copper oxide (YBCO). YBCO is a crystalline chemical compound and it is also a superconductor at high temperature. YBCO also produce high diamagnetic levitation effect. It has a critical temperature above 77K. YBCO is also economical and easy to fabricate.

## 3. Working of IC Engine

In an internal combustion engine the expansion of the high-temperature and high-pressure gases produced by combustion apply direct force to some component of the engine. The force is applied typically to pistons. This force moves the piston over a distance, transforming chemical energy into useful mechanical energy.

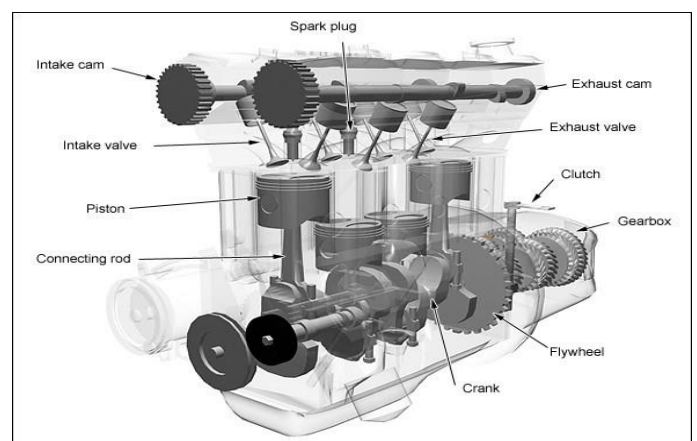


Fig:- Construction of IC engine

## 4. Combination of IC Engine and Electromagnetic engine

We can use both IC engine and Electromagnetic engine in same vehicle. As we use battery to run Electromagnetic engine, which can be charged by two ways. One by manual charging and another by waste heat recovery from IC engines exhaust system. We can convert waste heat from IC engine to electricity by using thermoelectric generator. On one side we

can supply the heat from engine exhaust and on other side we will try to keep the temperature low as much as possible. This will help in producing more electricity. Produced electricity is supplied to battery to run the Electromagnetic engine.

In the thermoelectric generation cycle, the heat from exhaust of IC engine is passed through the heat exchanger and transferred to the thermoelectric generator one side and other side of TEG is kept cooled by means of coolant or water. This produces temperature difference, which is converted to the electricity. That electricity is used to charge the battery.

We can use thermoelectric material such as,

- 1) Silicon germanium (SiGe)
- 2) Bismuth antimony (Bi-Sb).
- 3) Lead telluride (Pb<sub>2</sub>Te<sub>3</sub>)
- 4) Bismuth telluride (Bi<sub>2</sub>Te<sub>3</sub>)

### 5. Working of combination of IC Engine and Electromagnetic engine

Both electromagnetic engine and IC engine can work efficiently in one vehicle as wasted heat from IC engine is used to drive the electromagnetic engine. Also we can charge the battery manually to drive the electromagnetic engine. The shaft of both the engine is same and when one engine is running another engine can be disengaged by clutch and gear arrangement. When electromagnetic engine is working, IC engine will not work and when IC engine is working, electromagnetic engine will not work. As both the engines are on same shaft the reciprocal movement of permanent magnet in electromagnetic engine will cause to reciprocate the piston of IC engine that will

cause loss of work and efficiency will decrease to avoid this clutch arrangement is provided to disengage respective engine when other engine is working. This arrangement is provided in between the two engines on the main shaft and another arrangement is provided after the electromagnetic piston engines shaft to main shaft.

When there is requirement of high load or torque if this fulfillment is not done by electromagnetic engine, switching can be done to IC engine as IC engine can fulfill the need of high load or torque. When there is smooth running on road then electromagnetic engine works efficiently with no pollution. The battery used is a lead-acid battery which is chargeable and more effective.

Suppose there is need of high speed requirement then in case of electromagnetic engine by increasing current the magnetic force can be increased and also by using 555 IC Timer the time delay for polarity can be set in 555 IC Timer according to need. And if load is more on engine then also by increasing current magnetic force can be increased. All the control of engine can be done by using 555 IC Timer.

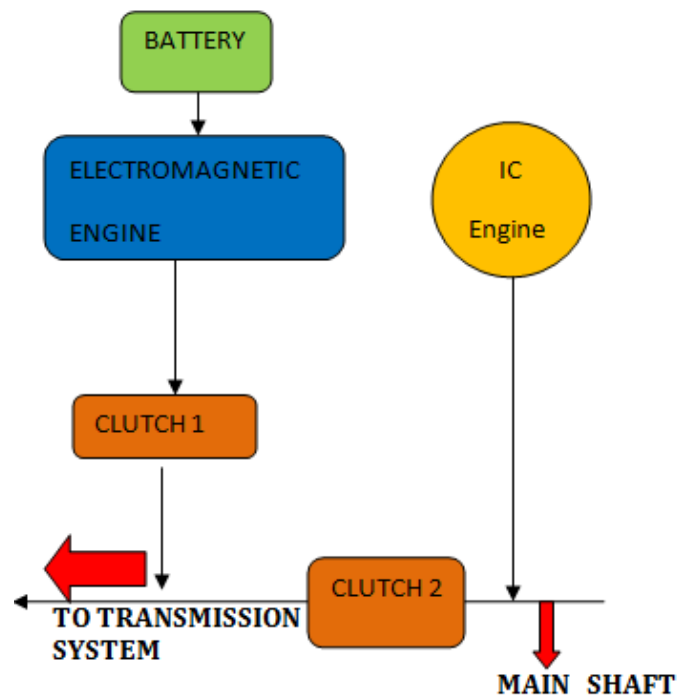


Fig: Block diagram of Combination of IC engine And Electromagnetic Engine

In block diagram shown above there are two clutches provided to engage or disengaged engine independently.

The heat from IC engine is utilized to charge the battery of electromagnetic engine by using thermoelectric generator as mentioned above. When clutch 1 is engaged clutch 2 is disengaged to avoid unnecessary working of reciprocal movement of piston of IC engine. And when clutch 2 is engaged then clutch 1 is disengaged to avoid the reciprocal movement of permanent magnet.

### 6. CONCLUSIONS

From the above discussion it is clear that waste heat energy from IC engine is used to charge the battery. This electrical energy is used to run electromagnetic engine. By using this combination of IC engine and electromagnetic engine, we can reduce air pollution and save heat energy from exhaust system by using thermoelectric generator.

But this system is bulky, due to combination of two engines and also initial cost is high. Construction is also difficult.

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