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Generation of Electricity with the Blades of Ceiling Fan

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ABSTRACT:
We all know everywhere there is huge scarcity of energy and for running most of our appliances and to carry out daily work we need electricity. It's really very difficult to imagine our life without electricity, our life would really stop so there is high need, to produce electricity at faster rate and find some other feasible method to produce electric energy. On the other hand we see that in this modern world temperature of the atmosphere is increasing rapidly.In order to survive and take relief from this unbearable heat humankind invented a technology which can circulate the air within the rooms to decrease the temperature called fans.More than half of the world's population uses ceiling fans. These ceiling fans takes electrical energy as input to perform their operation. Now just think if we would be able to generate electricity from a device that uses electricity itself for their operation.

INTRODUCTION

Electricity is one of those discoveries that have changed the daily life of everybody on the planet. Electricity is the key component to modern technology and without it most of the things that we use everyday simply could not work, and would never have been created. Our mobile phones, our computers, the internet, our heating systems, our television, our light bulbs nearly everything in the home would be different. There would be completely different systems to ensure that we can live properly every day. All the appliances require electricity to operate .And as fast as these world population is rising the electricity demand is also increasing drastically but compared to population generation of electricity not increasing due to which the transmission failure occurs frequently because electrical grid is unable to meet the consumer demand. For generation of electricity we have to think about innovative and feasible methods. One of the method for generation of electricity is through the ceiling fan blades.

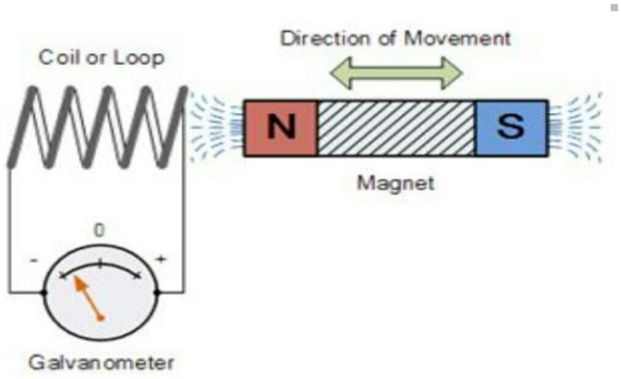
Lets see how…

- SCIENTIFIC EXPLANATION
- MAGNETS
- DISC OF WINDINGS
- INDUCTION MOTOR
- HOW IT CAN BE DONE PRACTICALLY
- SCOPE
- DEMERITS

SCIENTIFIC EXPLANATION

Ceiling fan convert electrical energy into mechanical energy.In order to achieve the motive we have to convert this mechanical energy into electrical energy.This can be achieved with the help of Faraday Law of Electromagnetic Induction. According to Michael Faraday "whenever there is a relative motion between the coil and a magnet then an e.m.f is induced in the coil". he also stated that "the magnitude of emf induced in the coil is equal to the rate of change of flux that linkages with the coil. The flux linkage of the coil is the product of number of turns in the coil and flux associated with the coil".

By following these principles we can generate electricity by replacing the ordinary metal blades by the magnetic blades.



MAGNETS

We can make these magnetic blades with the help of various magnets shown below:-

→RARE EARTH MAGNETS: These are strong permanent magnets made from alloys of rare earth elements (elements in lanthanide series, plus scandium and yttrium).Developed in the late 1970's,rare earth magnets are strongest type of permanent magnets and these are of two types neodymium magnets and samarium-cobalt magnets. They produce magnetic field of more than 1.4 Tesla.

→Alnico: Alnico alloys can be magnetized to produce strong magnetic fields and have high coercivity, thus making strong

permanent magnets. They typically produce magnetic field of 0.5-1.0 Tesla.

→Ceramic: A ferrite is a type of ceramic compound composed of iron(III) oxide combined chemically with one or more additional metallic elements. They are both electrically non-conductive and ferrimagnetic, meaning they can be magnetised or attracted to a magnet. They produce magnetic field strength of 0.35 Tesla.

In present time Neodymium replaced all the other magnets in commercial as well as in industrial applications because they give high magnetic field strength than the other magnets.

DISC OF WINDINGS:

To induce emf we need a set of windings that will cut the magnetic flux produced by the magnetic blades of the fan.A large disc of winding is made with the help of magnet wire or enameled wire is mounted just above the magnetic blades on the ceiling .Enameled wire is nothing but a ordinary copper and aluminium wire coated with a very thin layer of insulation. The wire itself is fully electrolytically refined copper. Aluminium magnet wire is sometimes used for large transformers and motors. The insulation is typically made of tough polymer film.

INDUCTION MOTOR

Induction motor works on the principle of electromagnetic induction. When the stator of a single phase motor is fed with single phase supply, it produces alternating flux in the stator winding. The alternating current flowing through stator winding causes induced current in the rotor bars (of squirrel cage rotor) according to Faraday's law of electromagnetic induction. This induced current in the rotor will also produce alternating flux. Now rotor should rotate in the direction of magnetic field to reduce its cause but in case of single phase induction motor the rotor does not rotates by its own, this can be explained by Double Field Revolving Theory. So rotor needs some external source to rotate. Therefore we go for capacitor start single phase induction motor.

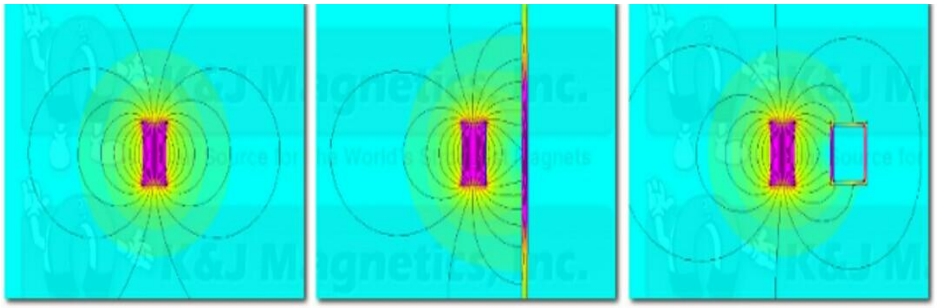
Hence we have seen that for the operation of single phase induction motor establishment of rotor and stator fluxes is necessary. No disturbances should be present between rotor and stator fluxes.

Therefore we have to apply protection from external magnetic field. Here external magnetic fields are the flux coming out from the magnetic blades of the ceiling fan. It can also be called as stray magnetic field for the motor.

PROTECTION AGAINST EXTERNAL MAGNETIC FIELD

First of all it must be clear that magnetic shielding does not block magnetic field. No material can stop the flux lines to travel from north to south pole of a magnet.

The field can however be redirected.



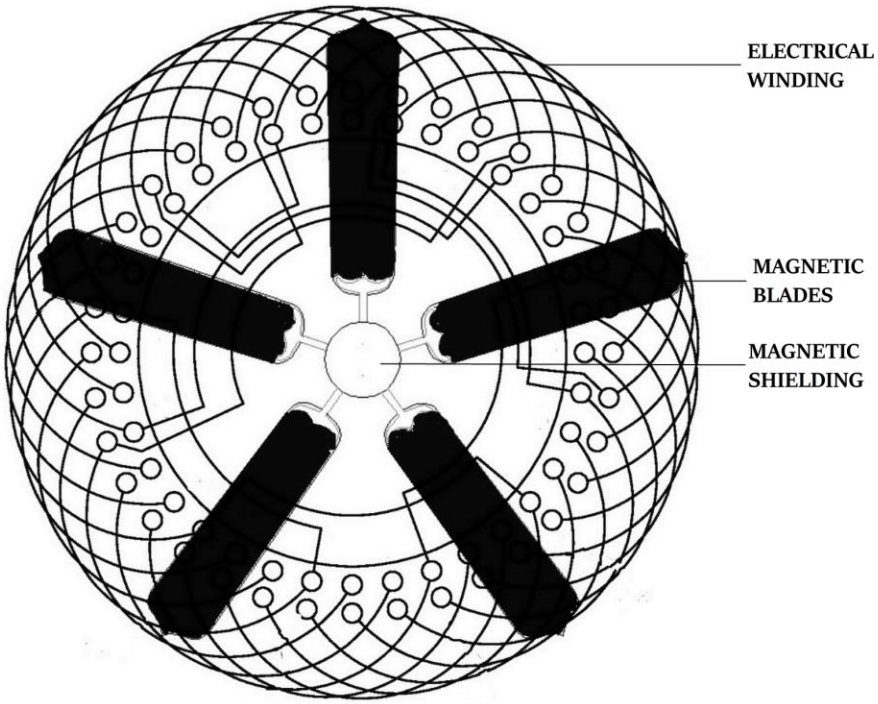
In the series of pictures above, follow the lines of flux as paths from one pole of the magnet to the other. In the first, a magnet in free space is shown, with the field lines flowing through air. In the second, a wall of steel provides an "easier" path for the lines of flux to follow. These lines flow out from the magnet's pole, into the steel for some distance, and back out into the air to get back to the magnet's other pole. In the third picture, a steel enclosure reduces the ambient field strength inside by providing a path around either side of the space.Steel have the permeability of 1000-3000.

Any ferromagnetic metal. That is, anything containing iron, nickel or cobalt. Most steels are ferromagnetic metals, and work well for a redirecting shield. Steel is commonly used because it's inexpensive and widely available. Holding capacity of shield also depend upon its thickness. When the shield is thin then it easily gets saturated and can't hold the flux lines further.For holding more flux lines we have to increase the thickness of the shield.

There are some fancier material are also available to shield the magnetic field of large strengths called as Mumetal.These have a high nickel content, with either 50% or 80% nickel in the mix.And have permeability of the order of 300,000 - 400,000. Mumetal has higher relative permeability and low saturation point. So for better shielding permeability of a medium should be as high as possible.

How to achieve the motive practically?

In present time more than half of the world's population uses ceiling fans. So this method can contribute widely to overcome the electricity problems across the globe. Problems like electricity failure, shortage of electricity in remote areas etc.



When excitation is provided to the induction motor then electrical energy is converted into mechanical energy and fan start rotating. Now by replacing the ordinary blades we can produce the varying magnetic field. The rate of change of flux is directly proportional to the rotation per minute(rpm) of the blades of the fan. Whenever there is linkage between the flux and the winding mounted just above the blades than emf is induced in windings due to Faraday's law of electromagnetic induction. This can be explained by following relations

$$B = \mu H$$

Where, B=Magnetic flux density

H=Magnetic flux intensity

μ =permeability of the medium

Now,

$$B = \frac{\phi}{A}$$

So magnetic flux density is also defined as the flux per unit area.

According to the Faraday's law

$$e = -N\frac{d\phi}{dt}$$

Where, e =induced emf

N =number of turns of the coil

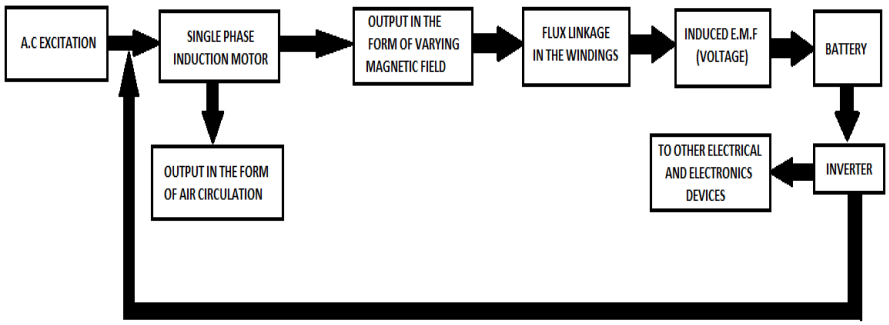
$\frac{d\phi}{dt}$ =rate of change of flux

Here - sign indicates the direction of induced current which opposes its own cause.

Therefore from the above relations we can say that when the magnetic field strength (H) increases then magnetic flux density (B) also increases and consequently flux (ϕ) also increases and with the increase in flux induced emf (e) also increases.

So, in order to get maximum output voltage the rate change of flux should be maximum, magnetic field strength should be high, and number of turns should be large as possible.

Another factor responsible for the magnitude of induced emf is the separation between the blades and the winding.The larger is the separation lesser will be linkage between flux and winding and consequently magnitude of induced emf will be less. Therefore, for the maximum linkage separation should be less as possible.



BLOCK DAIGRAM

Now, the voltage produced during this process is D.C and is stored in a battery. We have to use an inverter to convert this D.C voltage into A.C. because almost all the electrical and electronic devices operate through A.C voltage.

IT'S SCOPE

- If we will be able to generate electricity from the rotatory motion of fan efficiently then it could help us to reduce the development of mankind and reduction of CO2 as electricity is one of the cleanest energy.
- Many electrical and electronic devices can be operated on the situations like electricity failure.

DEMERITS

- Lots of work to be done in this field.
- Installation cost is very high.
- Turning of magnets into thin sheets is very complex and expensive process.
- Generation is not possible when temperature becomes low because then there is no need of fans.

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