Electromagnetic Induction In traction System

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Abstract— The paper based on utilization of induced voltage which is based on faraday's law of electromagnetic induction. In this paper the faraday's law of electromagnetic induction is used in traction system. With the help of the coil and magnet the voltage is induced in coil which are placed on both sides of track, and electromagnet will be placed on train. This voltage is utilized to power supply the electrical equipments which are used in traction system or electrical locomotives.

Key words: Faraday law, Magnet, Train, Electromagnet, Voltage

I. INTRODUCTION

This paper is based on the faraday's law of electromagnetic induction. This paper describes some basic points. According to faraday's law of electromagnetic induction, "when a current carrying coil is placed in magnetic field it induces the emf."[1].

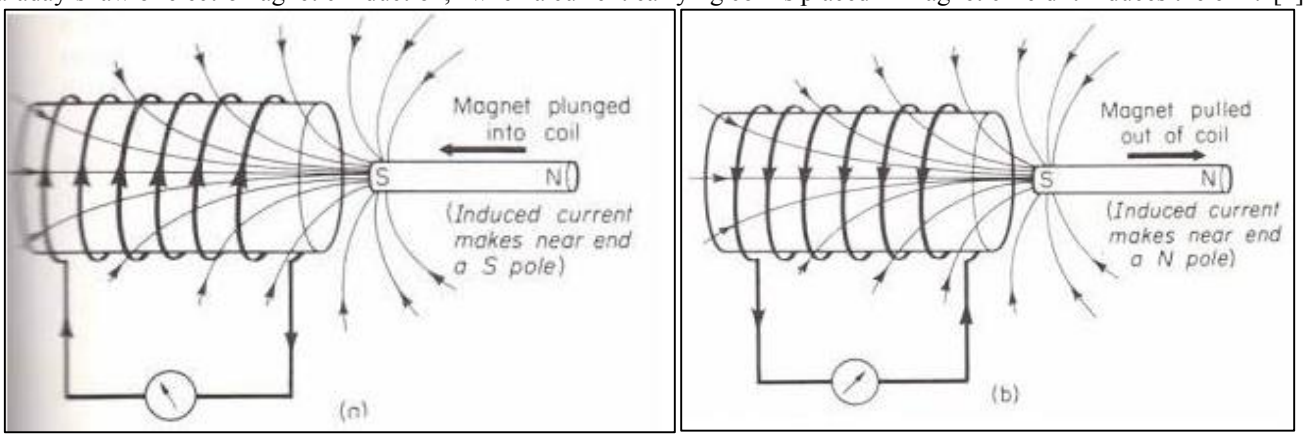

Fig. 1: of electromagnetic circuit

E = -N dφ/dt.
Where
E= induced EMF
N= number of turns
dφ/dt= rate of change of flux

Where negative sign indicates the direction of induced current in winding will be such that magnetic field produced will oppose the verb produced by it(acc. to lenz law)[2].

It is applicable in the paper, the flux is linked due to relative motion between static winding and moving magnet. So, the emf is induced in it.

II. CONSTRUCTION

In this paper the winding is made of copper coil and wound on the both sides of the track and bottom. The electromagnet is made in both the side and bottom of the train. Generated voltage is stored in receiver or power storing devices is used for utilization propose.

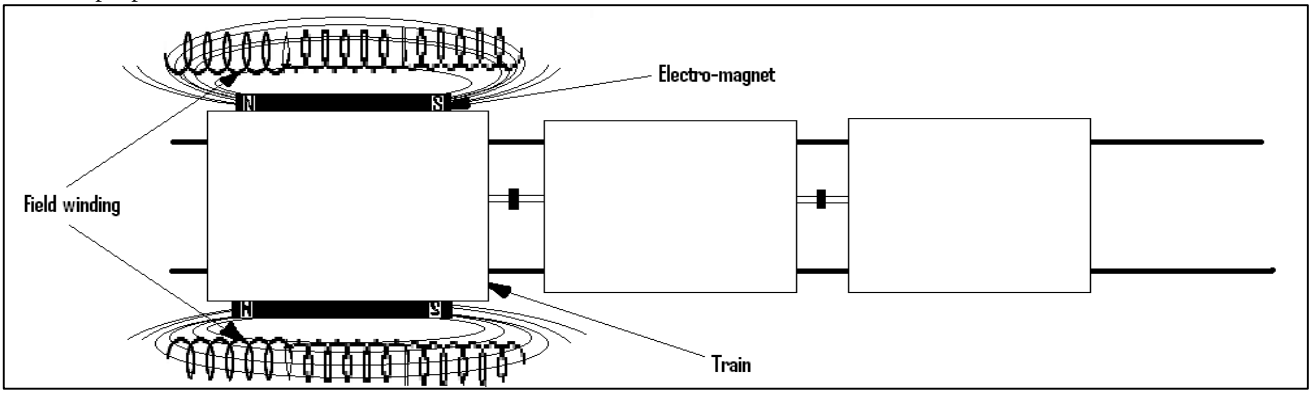

Fig. 2: of electromagnetic train

III. WORKING

The steady electric field is produced on both the side of the train because of the electromagnet present on both sides. Now relative motion is between electromagnet and winding. Due to this EMF is generated in the winding as per faraday's law. The E.M.F collection device is used to collect the induced E.M.F. The induced voltage is utilized in various purpose in traction system.

We compared our system with separately excited DC generator, because in this case the field is separately provided to the system. Hence it is used in the train for electromagnetic propose. Here output voltage in generated in armature due to relative motion between field winding and armature. In this system relative motion between electromagnet (train) and winding (track), then emf is generated in both side of winding. Here in the system rotational motion of generator is converted into linear motion using this formula.

Circumference of circle= 2*π*r

Where,

Circumference of circle= length of electromagnet(L)

r= radios of armature(mm).

IV. CALCULATION

According to the practical reading of separately excited dc generator[3]:-

Diameter of armature=200 mm

Speed of separately excited generator (N1)=1020 rpm

Output voltage=33v

Now,

Normally speed of the train is 100km/hr.

speed in m/sec =(Speed in km/hr*10^3)/3600

=27.77m/sec

$$speed\ in\ rpm = \frac{60000 * speed\ in\ m/s}{\pi * diameter(mm)}$$ [4]

$$= \frac{60000 * 27.77}{3.14 * 200}$$

=2653.9208≈2654 rpm

Speed of train = 2654 rpm

Generated emf in the one side coil is 85.86V

Circumference of armature = length of electro-magnet

So, length of electromagnet =$2*\pi\ \frac{diameter\ in\ mm}{2}$

=62.8 cm

Length of electromagnet is 62.8cm.

Length of one side of coil is ≈68.7cm.

Here, if speed is 1020 rpm than generated voltage is 33v

Similarly at 2654 rpm the generated voltage is 85.86 ≈ 86 v

A. Practical Aspect:-

Separately excited DC Generator			Train			
Speed (rpm)	o/p voltage (volt)	Field current (mA)	Speed (km/hr)	Speed (m/s)	Speed (rpm)	Generated voltage (volt)
1020	33	205.5	100	27.77	2654	85.86

Table 1:

V. CONCLUSION

In this project when the magnet is passed through the coil there was changing flux that produces the emf in the coil. This calculation is based on the faraday's law of electromagnetic induction whenever the relative motion between conductor and magnetic field, the flux linkage with a coil changes and this change flux induces a voltage across a coil.So we can conclude that the same can be applied in traction syayem. Although there are various challenges in order to implement it properly.

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