

# Design of Electromagnetic Levitation Conveyor

**Abhishek Tandel**

*Department of Mechanical Engineering  
Mahatma Gandhi Institute of Technological Education and  
Research Centre*

**Ruchit Tandel**

*Department of Mechanical Engineering  
Mahatma Gandhi Institute of Technological Education and  
Research Centre*

**Daxesh Tandel**

*Department of Mechanical Engineering  
Mahatma Gandhi Institute of Technological Education and  
Research Centre*

**Chintan Tandel**

*Department of Mechanical Engineering  
Mahatma Gandhi Institute of Technological Education and  
Research Centre*

## Abstract

Today in our modern developing area there is a need for an improvement in every sector. So we implement a conveyor which will use electromagnetic effect to levitate and which will overcome all ill effects over convectional conveyors. This levitated conveyor is known as ELECTROMAGNETIC AIR CONVEYOR. This kind of conveyor differs from convectional conveyors as it does not require any surface contact for traction and is able to move on many kind of surfaces supported by a self-generated levitation of air. The effects such as jerks, friction, lack of speed in conveying systems, etc. can be minimized. As the same is seen in maglev trains which levitate vehicles a short distance from a guide ways using the magnets to create both lift and thrust. So we imagine magnetic field generated through the copper coil which is conveying by the control system from start to end rapidly.

**Keywords: Electromagnet, Conveying, Levitation, Improved Transportation, Eco Friendly**

## I. INTRODUCTION

The rapid growth in modern developing countries globally has increased the use of conveyors in industrial fields for the flow of materials. So the handling of materials is essential as per the customer demands and the requirement of speedy transportation system is essential. The convectional conveyors face certain drawbacks due to its mechanism and other things such as it consumes more time for material handling, the increase in variation of properties due to thermal effects, it is slow to meet the manufacturing supply as well as in capital sectors as it plays more important role in industrial sectors. The electromagnetic conveyor is a kind of conveyor in which the conveying will be done through the electromagnetic power or force produced through a magnet and coils. This type of conveying system will overcome all ill effects of convectional conveyors and will be quick. Surely it will be better and will be a new kind of flexible material handling system.

## II. RESEARCH PAPERS REFERRED

The expression "Levitation" alludes to a class from claiming advances that utilization attractive levitation should propel. Vehicles for magnets as opposed for wheels, axles what are more bearings. Maglev (derived from attractive. Levitation) utilization attractive levitation on propel vehicles. With maglev, a vehicle is levitated a short (Levitation) utilization attractive levitation on propel vehicles. With maglev, a vehicle is levitated a short trains guarantee. Sensational upgrades to mankind's venture out broad reception happens. Maglev trains move that's only the tip of the iceberg. Easily and to some degree more quietly over wheeled impostor travel frameworks. Their no reliance around rubbing. Implies that acceleration and deceleration might surpass that about wheeled transports, What's more they are unaesthetic. Eventually Tom's perusing climate. The force necessary to levitation is commonly not an expansive rate of those in general vitality. Utilization. The greater part of the force is used to succeed air safety (drag). In spite of the fact that routine. Wheeled transportation might try exact fast, maglev permits schedule utilization of higher highest point speeds over. Routine rail, Also this kind holds those speed record for rail transportation. Vacuum tube prepare frameworks. Might hypothetically permit maglev trains on accomplish speeds on an alternate request for magnitude, yet no such. Tracks have ever been fabricated. Contrasted with traditional wheeled trains, contrasts on development influence. The trading and lending for maglev trains.[1]

Maglev need got to be that speediest rate of developing innovation in the field of railways foundation. The specialized foul. Determinations of such innovation would ruling on the accessible specialized foul foundation of the existing railways. Maglev trains which are dependent upon the standard for maglev bring been compared with helter skelter velocity transportations for example, such that. Air transport. Those principle points for this framework is will convey a productive result for those contemporary transportation issue. That prevails in the planet. Magnetic levitation provides fast, cost-efficient and environmentally friendly transportation and efficient speed of the moving train.[2]

In the review of electromagnetic howerboard says, over those world, building need those basic Moto will be - “Improving those caliber of Life” for humankind without at whatever confinements. Will accomplish this change clinched alongside science What's more innovation will be required. Those haul levitation alludes should a class about innovation organization that utilization electromagnetic levitation on propel vehicles for electromagnets as opposed for wheels axels Also bearings. Drift table may be a individual transportation gadget which lifts person, the place man cam wood encounters All the more smoothly same time moving. Drift boards are for the most part portrayed similarly as resembling a skateboard, at first sheets were In view of wheels Anyhow after adjustments also applying electromagnetic ideas sheets need aid committed without wheels. Drift table holds electromagnets in this way that conductivity may be aggravated time permits because of shock it floats Furthermore moves forward. Essential particular idea might be connected to further future transportations also to decrease constant issues for example, such that vehicle movement and so forth throughout this way, observing and stock arrangement of all instrumentation may be enha. Significant requisitions fall in the fields of medicinal Furthermore self-transportation. Notwithstanding A days jet built drift board will be imagined which will be Hosting astounding space.[3]

A levitation framework for levitating a levitated attractive component on an stable suspended position for you quit offering on that one side of a dividing plane utilizing an attractive plan on the inverse side of the dividing plane. Those attractive course of action gives a preselected static attractive field setup that interacts with a magnet in the levitated component so that those attractive possibility vitality for this association builds for displacements of the component starting with its stable position clinched alongside directions parallel will a Strength plane Also declines to displacements of the component from those stable position peroxide blonde of the solidness plane. Any development peroxide blonde of the solidness plane is sensed what's more utilized by a input control framework to control an energy connected of the levitated component will settle those component against uprooting starting with the stable position for directions peroxide blonde of the solidness plane.[4]

### III. WORKING PRINCIPAL

Magnetic air conveyor works on principal of “LEVITATION” conveyor. When the power (Electric) is given to the coils, the coils produces the electromagnetic effect which is generated below the floor, This provides the floor to float above the ground level and provides the ramp to have its lift.

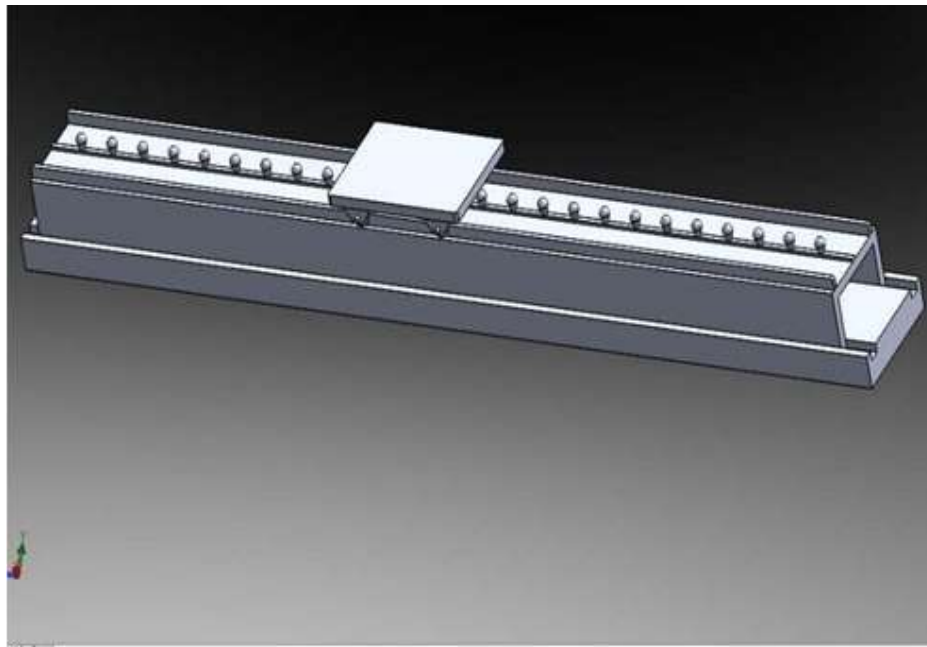


Fig. 1: Principal of Levitation

As shown in above figure, conveying mechanism works. The constant electrical current flows through the coil and due to this constant flowing current the coil develops magnetic field around it. A chamber of an array is created around so this results in opposing of magnetic field created between the spaces of ramp. Levitation is useful for motion of magnetic materials and this technique is very useful to convey the materials from one place to another in short time period and speedily

### IV. CONCEPT OF LEVITATION?

Use Magnetic levitation is a method of giving lift to a substance. The magnetic pressure of the coil opposes the gravitational force on a substance through which the lift is created. The basic concept of the levitation is to apply the electric current to an electromagnet to levitate. The space of both the phase is maintained by the magnets and voltage applied. According to the Earn

Shaw's theorem. It is not possible to stably levitate against gravity with only use of the ferromagnetic materials so Use of diamagnetic materials involving eddy currents should be used to achieve that. Therefore the construction of are conveying system is just like rails but the difference is that between both the guide ways many coils are arranged both the guide ways are separated with a distance. On the carriage made of aluminium and beneath which coil is install. To magnetic tapes are flattened as the length of guide ways which keeps the repulsion action on sideways. The power is supplied to the copper coils which is fixed between to guideways. MCB which acts as a safety instrument and which controls the safe transfer of current is installed before the coil for safety and flexible working.

## V. DESIGN CALCULATION

When the magnet is energized, the property of a magnet will tend it to lift the ferromagnetic material around its pole. The gravitational force is given by  $F = mg$  but for our lifting force of conveyor the assumed mass is taken as 500 grams to be lifted

Therefore the gravitational force is  $500 \times 9.81 \text{ m/s} = 4.90 \text{ N}$ .

So the lifting power should be greater than 4.90N

The area is given by  $A = \pi/4 d^2$

$$A = \pi \times [15 \times 10^{-3}]^2 / 4 = 1.767 \times 10^{-4} \text{ m}^2$$

$$= 4\pi \times 10^{-7} \text{ m} = 500 \text{ g}, g = 9.81 \text{ m/s}^2$$

$$F = B^2 A / 2\mu$$

$$\therefore 4.90 = B^2 \times 1.767 \times 10^{-4} / 2 \times 4\pi \times 10^{-7} \text{ From which B is calculated as } 0.0696 \text{ wb/m}^2$$

This is the flux density in the gap of air and is the same as the flux density in core from a very small air gap, total flux in core is given by:

$$\Phi = B \times A$$

$$A = 2\pi r l + 2\pi r^2$$

Where, r is the half diameter of the core and l is the length of the former.

If assumed r as 7mm and l as 20mm

Then the value of A will be  $1.1875 \text{ m}^2$

Hence flux obtained will be  $\Phi = 0.08265 \text{ Wb}$ .

Therefore the flux in the core and the flux of the air gap is same.

Finally the lifting power of force of the magnet is calculated using equations below:

$$F = B^2 A / 2\mu$$

$$= 0.0696^2 \times 1.1875 / 2 \times 4\pi \times 10^{-7}$$

$$= 5.88 \text{ N}$$

The magnetizing force(H) in the air gap is given by

$$H = b/\mu$$

$$0.0696 / 4\pi \times 10^{-7}$$

$$= 55385.9 \text{ AT/m}$$

Assuming the air gap 40 mm the magno motive force (mmf) is given by;  $\text{mmf} = H \times L$   $55385.9 \times 30 \times 10^{-3} = 1661.57 \text{ AT}$

This magneto motive force is the product of current that will go round the magnet and the number of turns of the wire that makes up the magnet. If one of the variable is chosen the other variable can be calculated, thus if the numbers of turns is chosen to be 300, then the current in the electromagnet is given by;

$$I = \text{mmf} / N$$

$$= 1661.57 / 300$$

Therefore the current is computed to be 5.54A

:- Further calculation of circular mills = working current density X current

$$1000 \times 5.54$$

$$= 5538$$

Based on circular mills the diameter and gauge of the wire is selected.

So for circular mill 5538, wire of GAUGE 29 is used for practical purpose.

:- Circular mills = working current density X current

So taking the current density 1000, multiplying current, circular mills can be obtained and through that the diameter and gauge of wire is selected.

And For determination of turns of wire needed,

- 1) The wire is to be wound on the former of the electromagnet. At this point the following parameters are known
- 2) The diameter of the former
- 3) The length of the pitch

And the diameter of wire to be wound is equals to,

The maximum number of winding in the first layer will depend upon the ratio of length of pitch to the diameter of wire wound in the single layer.

$$= \text{Length of pitch} / \text{diameter of wire wound in the single layer}$$

- But we know that single layer will not be enough so for more electromagneto motive force we would have to wound multiple layers of turns.

## VI. ADVANTAGES

- 1) Speedy: The conveying system creates less friction so the time which is required to transport material is less and also the whole system is quick so the time consumed is also less which helps the system to speed up
- 2) Reduces pollution: As the system is energized through electricity the emission control can be done more easily and effectively as the source of electricity generation at many point of generation. The surroundings has no effect through this conveying system and this magnetic system creates no kind of noise which is good for environment and also the working atmosphere for labours.
- 3) Less Maintenance: This system does not have motion relative to other objects in contact and behaves as contactless conveying system so the wear and tear is less compared to other convectional conveying systems so it has less or low maintenance.
- 4) Less skill labours: Low skill working can also do the same work as the skilled once so there is no need for skill workers in this system and ultimately the cost and time for training the workers is also saved.
- 5) Investment: The cost for instalment is to be considered and some kind of operation cost which will be reduced, there is not much of additional cost to be spend in future. It acts as one time investment.

## VII.APPLICATION

- Automobile Industries
- Coal Industries
- Airports
- Food packaging Industries
- Pharmaceutical drug Industries
- Paper Industries
- Cosmetic Industries
- Bottle Industries etc.

## VIII. CONCLUSION

It is concluded the project is very more favourable to the nature and can be operated on the electromagnetic force which is a renewable source of energy and which overcome most of the ill effects of convectional conveyors like friction, Noise, speed reduction, workers problems etc. however some work is to be done for improvement in the project. So we are publishing result and are hopefully desiring that this working principle will be a reason for a new start in material transportation systems.

## REFERENCES

- [1] Internet sources (GOOGLE)
- [2] Textbooks of std. 11 &12.
- [3] Morishita, Mimpei, Teruo Azukizawa, Shuji Kanda, Noburu Tamura, and Toyohiko Yokoyama. "A new maglev system for magnetically levitated carrier system." IEEE Transactions on Vehicular technology 38, no. 4 (1989): 230-236.
- [4] Yadav, Nivritti Mehta, Aman Gupta, Akshay Chaudhary, and Monika DV Mahindru. "Review of magnetic levitation (MAGLEV): A technology to propel vehicles with magnets." Global Journal of Research in Engineering 13, no. 7 (2013).
- [5] IEEJ transaction on electronics, information and systems vol. 125 (2005) NO. 4 P 600-606