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# Analysis, Testing and Implementation of Repulsive Magnet System to Reverse the Bearing Angles of Three Bearings and Shaft Mechanism in Winding Machine Application

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**Abstract**

Three bearings and shaft mechanism is used to convert the constant rotary motion of a plain shaft into a traversing action that moves an attached carriage used in positioning and reciprocating linear-motion applications. This mechanism is a mechanical alternative of electronically controlled linear-motion drive systems. It runs on a smooth, unthreaded shaft. The rotary input of the motor-driven shaft is converted into linear output by the action of specially machined bearings. The mechanism generating the linear output is friction between the bearings and the shaft.

The rate of the linear travel depends on the helix angle of the imaginary screw profile generated by bearings and the helix angle of the imaginary screw profile can be vary. To change the direction of the linear travel the helix angles of the screw profile generated by the bearings should be reversed and the reversal of the bearing angles is done by using the repulsive magnet system.

In this research paper the researchers has done the analysis, testing and implementation of repulsive magnet system to reverse the bearing angles of three bearings and shaft mechanism in winding machine application

***Keywords:*** *Shaft, lead screw mechanism, three bearings and shaft mechanism, linear drive, winding machine, repulsive magnet force.*

## 1. Introduction

This linear drive works on the principle of friction and linear thrust which generates the imaginary screw profile. The mechanism of frictional linear drive consists of an assembly of a shaft and three bearings. The bearings are mounted in such a way that it generates the imaginary screw profile on the shaft.

There is clearance between the shaft and bearing on either side of the ridge. This clearance permits the bearing to be pivoted, angled left or right on the shaft and still maintain point contact with the shaft.

A three bearing assembly is fixed within the housing. Each bearing is held at a specific angle relative to the shaft. When the shaft rotates, the bearings generate axial force on the central ridge. This causes the bearing assembly to roll along the length of the shaft. The rotary input provided by the motor-driven shaft is thereby converted to linear output. As the bearing assembly moves carries the tool mounting head with it.

Reversal of the mechanism is carried out by the repulsive magnets. When the reversal mechanism is triggered, the entire bearing assembly is flipped on the shaft to it's opposite to mirror position and reversal is instantaneous. The end stops are -positioned adjustable to determine the system's stroke length. Hence the triggering of the mechanism is contactless.

## 2. Repulsion property of magnet

Any object that exhibits magnetic properties is called a magnet. Every magnet has two points, or poles, where most of its strength is concentrated; these are designated as a north-seeking pole, or nort hpole and a south-seeking pole, or south pole, because a suspended magnet tends to orient itself along a north-south line. Since a magnet has two poles, it is sometimes called a magnetic dipole, being analogous to an electric dipole, composed of two opposite charges. The like poles of different magnets repel each other, and the unlike poles attract each other.

The magnetic forces between two poles followed an inverse-square law of the same form as that describing the forces between electric charges. The law states that the force of attraction or repulsion between two magnetic poles is directly proportional to the product of the strengths of the poles and inversely proportional to the square of the distance between them.

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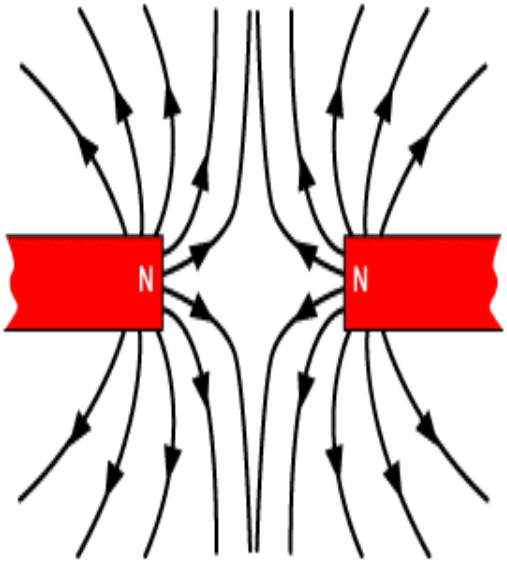



Fig 2.1: Repulsive force diagram between two same poles of two magnets

## 3. Design of end stop

The end stops are the elements which reverses the angle of the bearing plate hence the angle of the bearing changes which results into the change direction of the carriage.
The basic principle used for the reversing the direction of the bearings plate is repulsive force between same poles of two magnets. The end stops can be slide on the support rod and can be fixed. This sets adjustment of travel of the carriage.

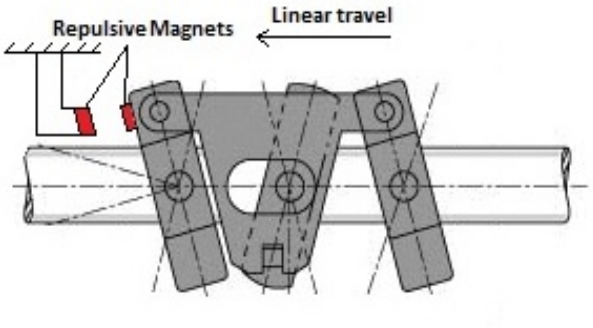
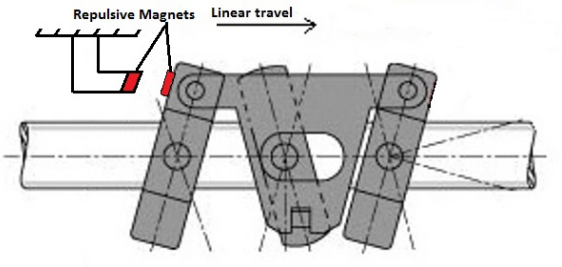


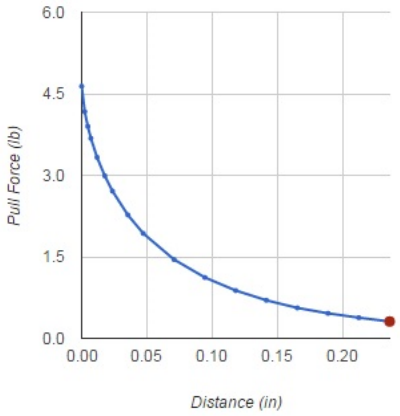

Fig 3.1: Position of magnets and end stop before reversal of bearings




3.2: Position of magnets and end stop after reversal of bearings

## 4. Force analysis on the magnets

As the magnets are been used to reverse the angles of the bearing plates, the repulsive force generated by the same pole of the magnets are been calculated.



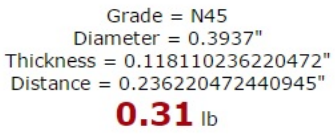




Fig 4.1: graph of distance and repulsive force

Considering,
The grade of magnet: N45
Distance between two similar poles of the magnet = 0.2362 inch = 6 mm
Diameter of the magnet= 0.3937 inch = 8 mm
Thickness of the magnet =0.1181 inch = 3 mm
Hence,
Repulsive force = 0.31 lbs = 0.1406 kg.

## 5. Conclusions

The conventional spring actuated end stop system is been replaced by repulsive magnet system hence the reversal of the mechanism is been done by contactless mechanism hence there will not be any wear and tear between the carriage and end stops.

The repulsive force generated by the magnet is 0.1406 Kg which is safe to change the direction of the bearing.

## References

[1] Florian Thaden, Paul Beutin, Hauke Reese, Reversal mechanism for a rolling ring drive, WIPO, 2015.
[2] George Wardley, A traversing unit, Espacenet, 1981.
[3] Gordon L. Bauer, Traverse mechanism, USPTO, 1976