

Magnetic Roller for Lifting Toast Box Case

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Abstract - For years, magnetic lifter is been targeted at reducing the material handling required and the time taken behind it. The introduction of magnetic lifer using permanent magnets is the new era of material handling. The main motive of our project is to use the conventional permanent magnets for the material handling process and to reduce the breakdown time taken due to the maintenance of the electromagnets. The method used in our project is the use of line shaft rollers with permanent magnets at the Centre for lifting the box cases, due to use of the permanent magnets rather than the electromagnets the maintenance time as well as the cost of the system and the complexity is reduced leading to effective and convenient material handling. Effective material handling can be obtained by changing the numbers of rollers used in the magnetic lifter and the proper angle between the horizontal base and the assembly. A magnetic lifter offers approximately 25% reduction in maintenance time and 45% reduction is the cost of electricity consumption. Thus this technique of magnetic lifting is useful to balance the power requirement and the cost of the manufacturing

Key words: magnetic lifter¹, material handling².

1. INTRODUCTION

The working principle of our project is based on the principle of magnetic attraction. The main problem faced by the industry was the manual lifting of toast box covers using labours. Hence we had to come up with our project. The main components used in our project are magnetic roller that perform the main action of lifting and transporting the box cases.

The magnetic rollers consists of a hollow steel rollers with permanent magnets filled inside it. The main assembly consists of rollers arranged in such a way that when the toast box case gets lifted up due to the magnetic roller, due to the continuous rotation of the magnetic rollers the toast box case further travels through all the rollers and finally after coming under the non-magnetic roller the box case falls on the upper belt conveyor which is implemented for carrying the box cases to the plant. In this project proper coordination of each and every roller is a must in order to successfully lift the box case and to reduce the labour required for manually lifting the box case.

The main objective of our project is to implement the engineering concepts in order to increase the production of the industry and to reduce unfavorable factors such as maintenance time required, reduce the workforce were ever possible in order to maintain proper hygiene and sanitation and also to reduce the relaxation allowance given to the labor in order to carry the task. We understand the problem faced by the toast making industries due to which we are trying to implement the knowledge we gained in our engineering, to increase the efficiency of the production processes of the industries. Our main motto was to make the project simple and effective so that proper installation and servicing can be done if required. We are currently pursuing to do our best in applying the basic concepts of magnetism in industries in order to simplify the complex processes and also to ensure that the magnetic roller conveyor works at its maximum efficiency.

2. PROBLEM STATEMENT

The main problem in our project is the conventional way of lifting the toast box cover by manually lifting it. As there is a labor implemented for lifting the box covers the major problem faced by the industry are as follows,

- a) If labor are unfocused during their working hours they might miss to lift the box case due to which it may lead to delay in the unit processing of whole plant.
- b) The working capacity of labor are around 5-6 hrs. Due to which we have to implement another labor which leads to extra wages for labor.
- c) If there occurs any conflict between the labor union and the plant manager then it may cause the whole plant to shut down.
- d) During working hours when the conveyor belt is at full speed then, condition may arise that hand of the labor may get struck in conveyor while lifting the box case.

3. DIFFERENT METHODOLOGY

In today's world magnetic lifter plays imp role in making our industrial process easy. Following are the 2 types of methodology that can be used for lifting the box case.

3.1 Magnetic lifter with magnetic core at the center.

3.2 Magnetic conveyor belt.

The above 2 types of magnetic lifter are described in brief

3.1 Magnetic lifter with magnetic core at the center.

Magnetic lifter with magnet at center is used in plier industries. The permanent magnet plays an important role in this lifter. The setup contains a permanent magnet at center of mechanism. Support the pulleys are installed on both the side of the permanent magnet. Further a rubber belt is installed on support pulleys and with magnet at center. Out of the two support rollers 1 is in rotation with the main source and both the rollers are further linked with each other hence, as roller 1 rotates the roller 2 also rotates in the same direction as roller 1. Proper height adjustment of the system is done so as the plier can be lifted properly transported to the packaging dept. When the plier comes in contact with the magnetic lifter it gets lifted due to the magnetic force of attraction on gets attracted to the rubber belt. As the rubber belt is in continuous rotation with the help of two support rollers the plier is also transported till the other end of the system. The plier detach from the rubber belt on the other end the system when the magnetic field gets weakened.

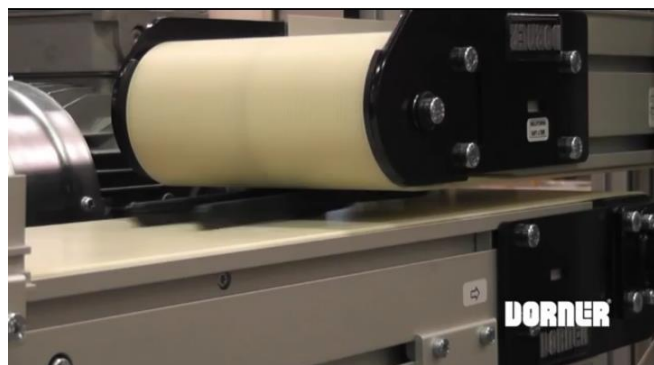


Fig.1: Magnetic lifter with magnetic core at centre

3.2 Magnetic conveyor belt

Magnetic lifter with magnetic conveyor belt has wide range of application. It is mainly used in tin making industrial for transporting the manufactured tins. As the tins are made up of soft metal it can be easily transported by using this system. This system consist of a magnetic conveyor which is made with the help of permanent magnet. When the tins need to be transported from one section of the plant to another then they are transported with the help of this conveyors. When the tin is in contact with the conveyor

belt it gets lifted and get struck to the magnetic conveyor. Further the tins are transported from one section to another section



Fig.2: Magnetic conveyor belt

4. PROPOSED METHODOLOGY

The working principle of our project is based on the principle of magnetic attraction between magnet and metal box. As discussed earlier the main problem faced by the industry was the manual lifting of toast box covers using labors. Hence we had to come up with our project. The main components used in our project are magnetic roller that perform the main action of transporting the box cases. The system consists of total 13 rollers out of which 12 are magnetic rollers and 1 nonmagnetic roller. Total 26 rollers are provided in order to support the 13 rollers from both the sides. Steel guiding are provided on both sides of the assembly in order to support the box case while lifting and travelling along the rollers. The first 12 rollers do the major part in the lifting the box cases.

Form the oven a lot of 6 boxes arrives on the conveyor no 1. The conveyor starts only if sensor senses 6 no. of boxes as it programmed accordingly. When sensor senses 6 no. of boxes the conveyor belt starts. The conveyor belt is made of metal as the boxes are hot. The conveyor 1 then further transfers the boxes to the conveyor 2. The distance of the conveyor 3 from conveyor 2 is around 1m due to which we get only around 1 second of time to lift the case of an individual box. When the boxes enter the conveyor no 2 they gets slowly admitted near the 'Magnetic Rollers' Proper height adjustment is done of the roller no 1 so that it can attract the box cases. When the box comes in contacts with the roller the roller attracts the box case and it gets struck to the roller no 1. The rollers are connected to each other using chain arrangement so that all the rollers rotate continuously in the same direction and with the same speed. The roller 1 gets its rotation from the main conveyor belt gear, as the roller 1 rotates, with the help of chain the rollers rotates accordingly.

When the box case gets struck to the roller no 1 as the conveyor belt 2 the roller are in continuous rotation of the box case gets travelled with the help of roller no 1 further gets attracted to the roller no 2. Further from

roller no 2 it gets transfers to the roller no 3 and further to roller no 4 and so on up to roller 13. The gaps between the rollers are calculated such that the rollers are in always contact with the box case. We are going to provide guiding's along both the sides of roller so that the box case travels perfectly between the guiding's and does not misalign or leave the contact between rollers. In this project the magnetic rollers do the major role of transporting the box case but the nonmagnetic roller also plays a vital role in our project. When the box case travel to the nonmagnetic roller, due to nonmagnetic roller the box case falls on the upper conveyor belt. If the nonmagnetic roller is not provided then condition may arise that the box case may not leave the assembly at all and may jam the assembly line. Hence, for proper ejection on the box case the non-magnetic roller is provided at the end.

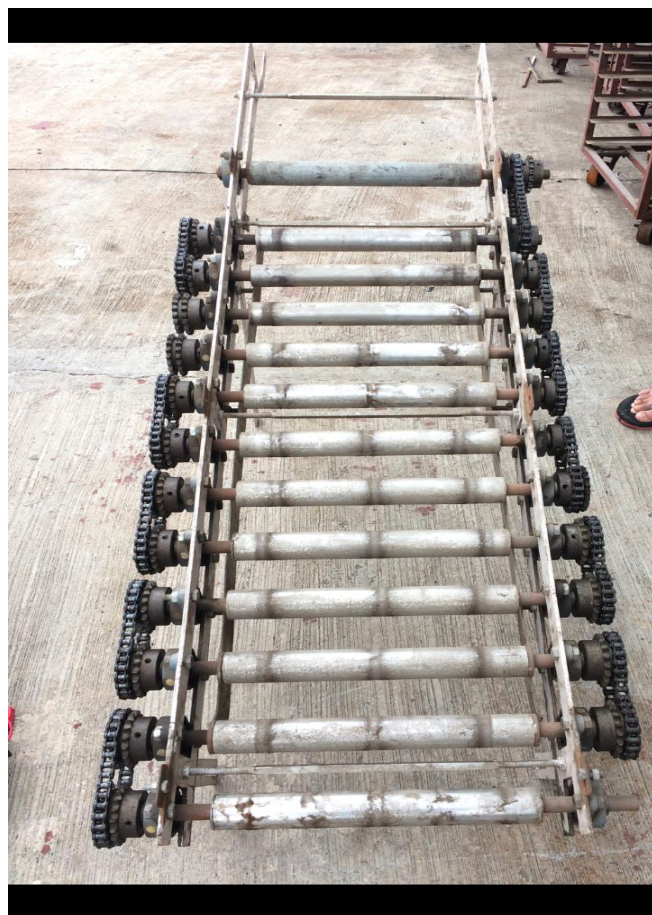


Fig.3: Magnetic Roller for lifting box case

5. ADVANTAGES AND APPLICATIONS OF MAGNETIC ROLLER

The advantages are numerous with regards to its applications. They are listed below,

- The permanent lifting magnet scores well over the conventional manual lifting as safe rides are guaranteed.
- Serious consequences are given no room which is not the case when manually shifting.
- The pace at which work is completed is incomparable, saving on time and money.
- Shipment or unloading will be carried out without hassle and within the scheduled duration without damage.
- Labor cost can be cut down.
- High corrosion resistance.
- High physical strength.
- High temperature resistance.

The applications of the system are as follows,

- For handling of steel plates, blocks, rounds, press moulds and loading/unloading on machines.
- Very handy during fabrication.
- Commonly used near flame cutting.
- Can handle finished components without leaving behind any scratch marks, unlike binding and slinging.
- Can be used with spreader beam hanging multiple magnets for long plates/ pipes/bars.
- Piling or stacking in containers for shipment.
- Transferring coiled steel sheets to processing or cutting area.
- Warehouses where heavy material handling is regular.

6. FUTURE SCOPE

In industries material handling has become an important parameter. The lifting and transporting now a days require a lot of electrical energy for equipment's and machinery.

Magnetic roller with permanent magnet at the center can be used in order to handle the components made of metals. Due to use of this system there is a reduction in consumption of electricity and the labour required. Permanent magnets does not require any type of power source for its operation, unlike electromagnets. In order to save the high installation cost and maintenance cost of electromagnetic system Magnetic Rollers conveyor with permanent magnet at the center can be used.

7. CONCLUSION

Other than our system, the other two types of systems as discussed above in the paper the installation cost is high,

the service and other factors affecting cost increases the cost of the belt.

Whereas in our project the construction is simple and not complicated, the installation is simple, the service and maintenance cost is less and gives the expected result. We understand the problem faced by the industries when it is related to material handling and transportation. We are trying our best in order to minimize the idle time and the maintenance time taken by the electromagnet conveyors by implementing and promoting the use of permanent magnets for material handling.

The main motive of our project is to use the conventional permanent magnets for the material handling process and to reduce the breakdown time taken due to the maintenance of the electromagnets. The method used in our project is the use of line shaft rollers with permanent magnets at the center for lifting the box cases, due to use of the permanent magnets rather than the electromagnets the maintenance time as well as the cost of the system and the complexity is reduced leading to effective and convenient material handling.

Effective material handling can be obtained by changing the numbers of rollers used in the magnetic lifter and the proper angle between the horizontal base and the assembly. A magnetic lifter offers approximately 25% reduction in maintenance time and 45% reduction in the cost of electricity consumption. Thus this technique of magnetic lifting is useful to balance the power requirement and the cost of the manufacturing.

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