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DEVELOPMENT OF AN AUTOMATED CHIP REMOVAL MECHANISM FOR CNC CHINA ANGLE DRILLING MACHINE

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ABSTRACT

Every machining process in industries produces chips which can cause hindrance in any fast and efficient machining process, if not handled properly. In today's world where increasing efficiency and speed are top most priority, handling of chips should become faster by providing automation in this process.

In KEC international limited where we worked along with our co-guide Mr. Anil Patne we developed an efficient conveyor belt system for faster handling and removal of chips after drilling operation in CNC angle drilling machine without turning it off .The conveyor belt is installed in a dig 2m below the ground level where all chips fall. An additional vertical stopper is also provided laterally along the belt. Hinged up side walls are also installed so that chips won't fall elsewhere except on the belt. From there the path of the belt goes straight horizontally for 1m and then rises up by 160 degree from below ground level to ground level. This total distance covered by the belt is 3750mm or 3.75m. From there the chips are dropped in a hopper.

1 INTRODUCTION

The manufacturing sector is growing day by day along with it the demand of faster and more reliable products. In KEC international where our group worked, angles (upto 5m) were manufactured and drilled according to the order, which were then used in assembling of telecommunication towers.This drilling of angles at KEC is done by a CNC angle drilling machine. This operation produced large amount of chips due to which after certain time the machine had to be stopped as it hindered with the cutting tool, work piece and the entire drilling process. Someone had to manually go down in the dig below the machine to pick the hopper where chips fell. During this manoeuvre the machine had to be stopped as a man had to go beneath it to pick up the chips.This problem was solved by providing a conveyor belt in the dig below the machine where chips fell. The dig had to be rebuilt like a tunnel of 3-4 metres for the passage way of conveyor belt assembly. The chips would directly fall on it by a hopper and transported to another hopper from where it would be taken for scrap. This process is continuous and doesn't

require the drilling machine to be stopped. Chips are handled properly and the operation can be carried out without any stoppage. Thus making the drilling process faster and saving a lot of time.

2. LITERATURE REVIEW

1. A Review on Design and Experimental Analysis of Flight of Drag Chain Conveyor Belt with respect to its Breaking Strength by Varying Flight Material. (International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 3, March 2016):- In engineering various researches has been done on the Conveyor system like Drag Chain Conveyor, Roller Conveyor and Belt Conveyor system. Conveyor systems are especially useful in applications involving the transportation heavy of bulky materials. Drag Chain Conveyor System can handle the material in horizontal directions. The following research paper helped us in better understanding the chain conveyor.

2. Type of Conveyor System: A Review (IJSRD -International Journal for Scientific Research & Development| Vol. 2, Issue 12, 2015):- Conveyor equipment selection is a complex, and sometimes, tedious task since there are literally hundreds of equipment types and manufacturers to choose from. The expert system approach selection provides advantages of unbiased decision making, greater availability, faster response, and reduced cost as compared to human experts. Conveyor types are selected on the basis of a suitability score, which is a measure of the fulfillment of the material handling requirements by the characteristics of the conveyor. The computation of the score is performed through the Weighted Evaluation Method, and the Expected Value Criterion for decision making under risk. This paper discusses the work done by the different researchers for the development of conveyor system for industrial purpose.

3. Design, Modeling and Analysis of conveyor system used for transportation of Cartons (International Journal of Research in Advent Technology, Vol.4, No.1,January 2016):- Conveyor is used in many industries to transport goods and materials between stages of a process. Using conveyor systems is a good way to reduce the risks of musculoskeletal injury in tasks or processes that involve manual handling, as reduce the need for repetitive lifting and carrying. Conveyors are a powerful material handling tool. They offer the opportunity to boost productivity, reduce product handling and damage, and minimize labor required in a manufacturing or distribution facility.

3. METHODOLOGY

3.1 DESIGN

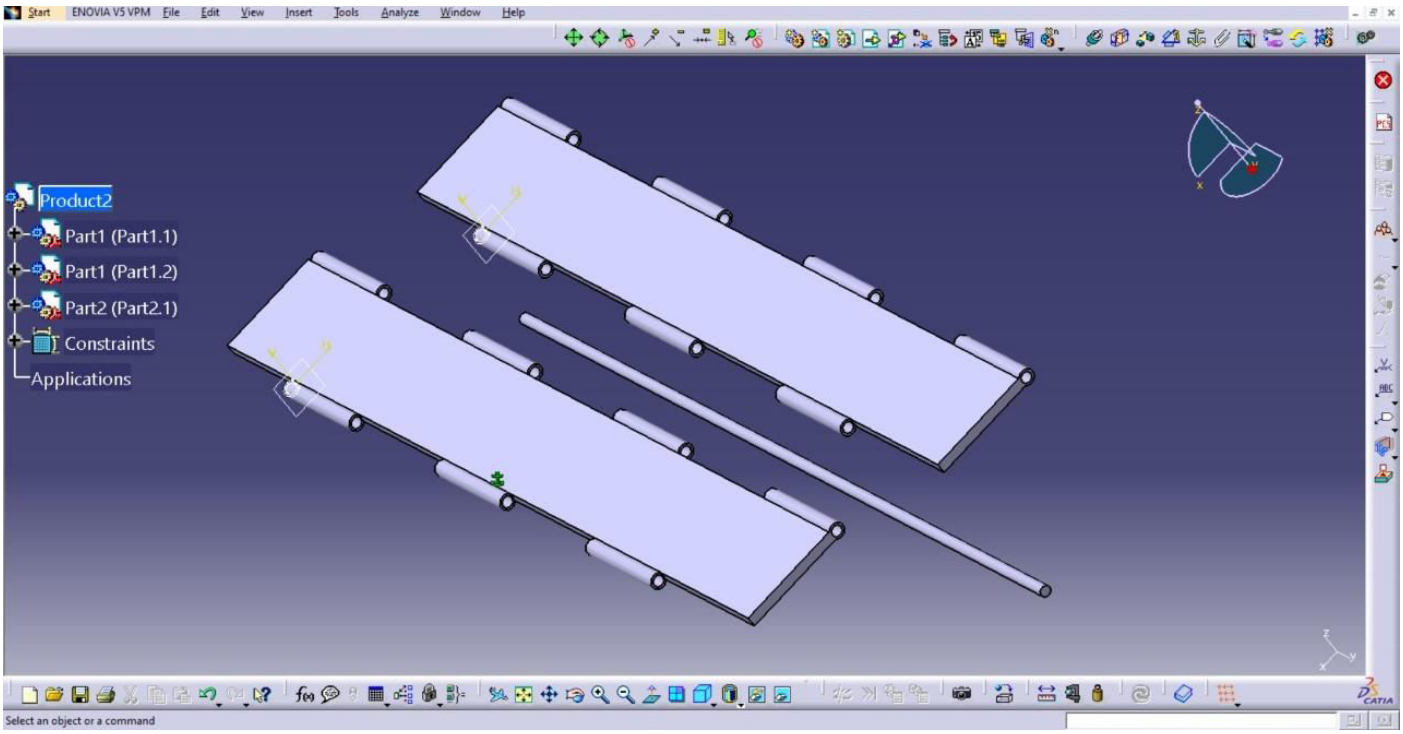
This is a rotating type of **'Chain Conveyor Belt'**. The belt is driven by a motor of output ***1.5 kW/h***. This motor is connected to sprockets at the start of the conveyor. The sprockets are linked with chains, which are in turn connected to the interlinked metal plates. The metals have a **hinge type** interlinking between them. A metal rod that passes through the plates is connected to the chains. The conveyor belt has two ***bends of 160^0*** and that is why the hinge type of metal plates are used.**A guide rod** is under the chain to ensure smooth movement. There is another set of sprockets at the other end of the conveyor belt with the same function as before. The structure has supports at each end and also at the bends of the conveyor belt. The motor also has a speed reduction gear box in order to regulate the speed of the with respect to the speed of falling chips. After ***every 8 links*** on the belt, **a metal plate, perpendicular to the belt** is welded to it, to prevent chips from falling backwards due to the incline. A hopper is connected directly to the drilling machine at one end and the other end of the hopper stops just above

the belt, thus ensuring that the chips fall on the belt itself. On the other side of the belt a drum is placed just below the belt in order to collect the chips carried up by the belt.

3.2 WORKING

For the automation of chip removal mechanism, 'Chain Conveyor' is used. The drilling machine and the conveyor belt are started at the same time. The drive system used is a 1.5kW/h motor, whichis used to drive the conveyor belt. The conveyor belt starts moving in an **anti-clockwise direction** with a speed of ***30 rpm.*** The actual speed of the motor ***is 1370 rpm***, this is brought down using a speed **reduction gear box.**Once the drilling starts, chips start falling on the conveyor belt with the help of the hopper. The chips fall at a rate of ***208.3 grams/ minute***. The chips are carried up by the belt, falling of chips is prevented by the **vertical metal plates**and dumped in a drum placed just below the end of the conveyor belt. The drum has a capacity of carrying ***50 kg of scarp***. After the drum is filled up to its capacity, it is replaced with another drum while the belt is stilling in operation and thus the drilling does not need to be stopped. As the rate of falling chips is very low, the spill at the drum end of conveyor while replacing the drum is negligible.

3.3 Design of Metal plates of Conveyor Belt



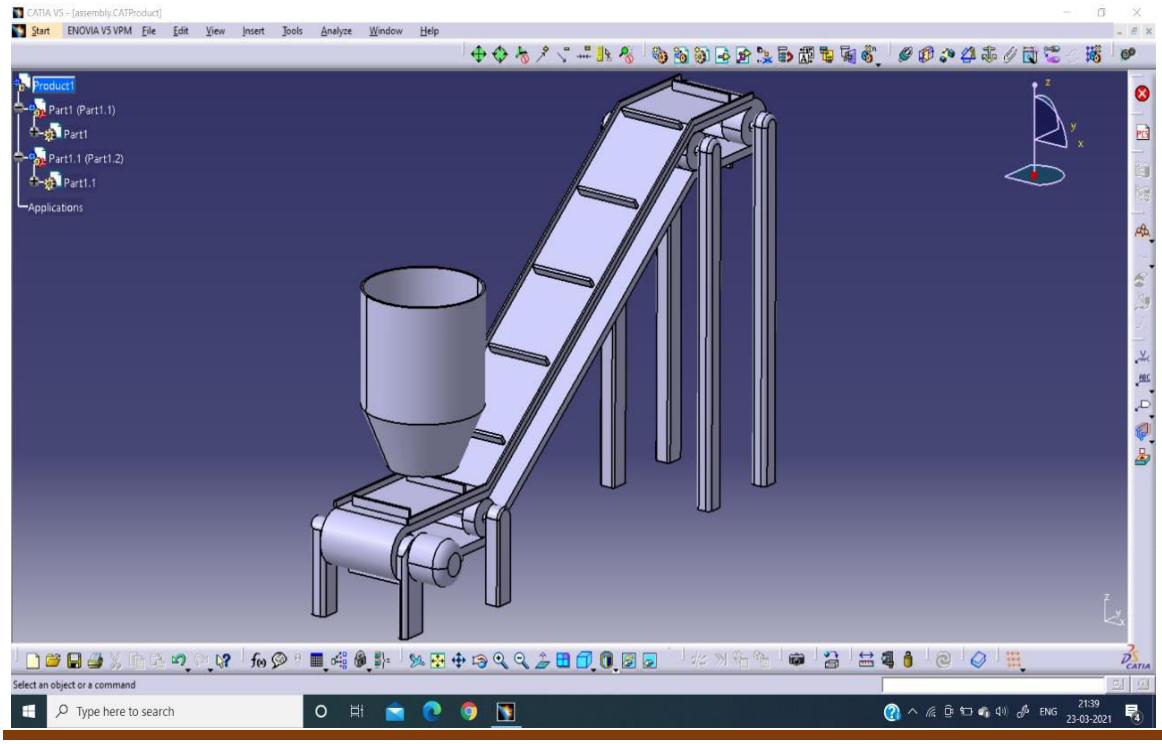
4. DESIGN DETAILS

The conveyor belt is 7.5 feet long and 400 mm wide and has bends of 160^0.

The conveyor plates and hopper are made from stainless steel.

COMPONENTS	SPECIFICATIONS
Electric Motor	1.5Kw 3phase ,45rpm
Conveyor belt	15000mm, mild steel, hinged
4xSprocket	Carbon steel
Hopper	Lower diameter=350mm, Upper diameter=800mm
Conveyor belt	15000mm
Conveyor belt plates	L=250mm, B=50mm, Thickness= 3mm
Chain	Welded steel

5. CAD Model of Automate Chip Removal Mechanism



COMPARISON

1.1.1 Old Mechanism

A drum is kept directly under the drilling machine. Once it is filled to its capacity with chips, the drilling machine is stopped and the worker go underground to take out the box filled with chips.

Every time the collection box is filled, the drilling is stopped and chips are extracted, then the box is placed back into its place and drilling continues.

An hours' worth of time is wasted and workers are sitting idly during this whole process. Also, this mechanism comes with major injury risks.

This method has proven to be very inefficient and time consuming.

1.1.2 Proposed Mechanism

Instead of manual removal, we have proposed a conveyor belt to carry chips out from below the drilling machine and to a safe distance from where it can be disposed of easily.

This automation significantly reduces risk of injury and removes the need of stopping the drilling machine in order to dispose off the chips.

6. CONCLUSION

By taking into consideration all of the aim and objectives of our project, we are concluding that the automation of the chip removal process will increase the efficiency of the whole process, decrease idle time of workers and also very importantly reduce the risk of injury to the workers.

7. References

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