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Design and Development of Knot making Mechanism

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***Abstract:** This machine is developed for S.V. Enterprises. It is small firm which deals in production of wire bundle which are used for hanging clothes. The worker has to engage metallic hooks by knotting it at the ends of wire manually which consumes more time as the material is stiff. The manual force required and time is more than the normal work. Hence, the firm is not able to reach the market need. Thus, requirement is to develop a machine to tie a knot in order to reduce manual force and time consumption. This paper discusses the detailed working of the machine to make simple overhand knot using pneumatic actuation.*

***Keywords:** Knotting mechanism, Knot making, Guided pathway, Pneumatic Cylinder.*

I. INTRODUCTION

Knot is a fastening made by looping a piece of rope, or something similar on itself and tightening it. Basically knots may be classified as hitches, bends, splices, or knots. A hitch locks a rope to another object; a bend combines two rope ends; a splice is a multi-strand loop. There are several variety of knots, each with properties that make it suitable for a range of tasks. Some knots are used to attach the rope to other objects such as cable, block, ring, or stake. Some knots are used to constrict objects. The type of knot to be made is simple overhand knot. The overhand knot is one of the most commonly used knots, including the simple overhand loop.

Generally, the knot is easily made by low hardness material such as cotton rope but when the material hardness gets increased, tying a knot to this material is very difficult. The material for which the knot is made is Polyethylene terephthalate. PET is highly flexible, high hardness and semi-crystalline material. The PET material has high melting point hence it makes the material hard. Tying a knot for this material manually is very time consuming, hectic and requires more effort. So we developed a knot making mechanism as a solution of above problems.

Fig a. Simple Overhand Knot

II. PROBLEM STATEMENT

Tying a knot with engaging the hook manually resulting – fatigue, less production rate & more time consumption. This project takes the liberty to design and implement an effective mechanism to achieve this specific task. However, the mechanism must be a simple and cost effective mechanism. Therefore, this project was designed for simple pneumatic mechanism to achieve the task. The worker faced the problem to engage the hook into wire and tying the knot. It becomes much complicated for him to do the task efficiently. So, the mechanism makes the work simple and easy thus fulfilling the work requirement.

III. LITERATURE REVIEW

A. Developing The CAD Software Is Used For Machine Design:

This paper provides a knowledge of computational electromagnetic. There are major three areas like Design, optimization and material selection for the machines. The CAD software like CREO, CATIA, AUTOCAD, etc. used for developing the design of the machine and its components.

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B. Automatic Pin Reloading

In this, u-clip is used to the bag leak proof as a solution of problem but one by one tying makes task slow so they make continuous loading of clip, as the loading makes continues one after another work gets faster than usual, we used these continues automatic loading for engaging the hook in knot of wire end so the work gets faster, easier and more productive.

IV. MECHANISM AND WORKING OF KNOT MAKING

A. Architecture

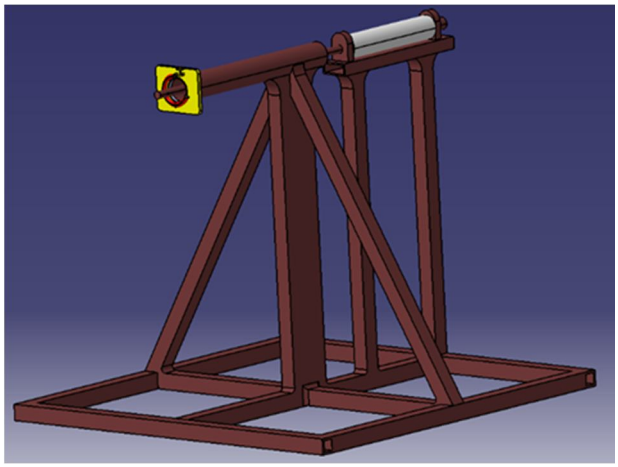

Fig.B CATIA Model Of Knotting Mechanism

B. Working

Every machine has its two parts mainly body which consist of whole mechanism (moving parts) and other is frame (rigid and fixed) usually gives supports and protect in mechanism from shocks or vibrations produce in it as shown in Fig.B.

As shown in Fig.B-1 mechanism includes Pneumatic cylinder , Curved tube (PET material) and Hollow shaft . Frame simply consist of truss member provided at center of mechanism to absorb vibration or shocks.

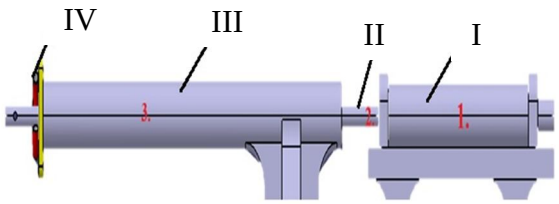

Fig.B-1 Mechanism Structure
I-Pneumatic cylinder, II- Piston,
III-Hollow Shaft, IV- Curved tube.

1) The machine includes a table support which carries a truss member, on which the main hollow shaft is fixed.
2) The dimensions of hollow shaft used according to loop formed during the knot and length according to stroke of the piston of cylinder.
3) The pneumatic cylinder (145 psi, 250 mm stroke, bore 16 mm) mounted over a cantilever support which is welded on the truss member. The pneumatic cylinder is supplied with the air pressure through a air compressor. The exact force required to tie efficient knot obtained by spring load test with various loads as shown in Fig.B-2 below.

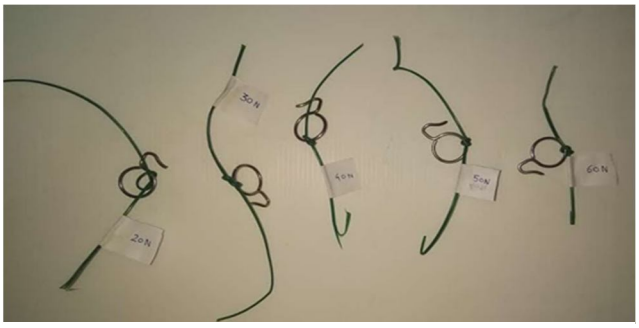

Fig.B-2 Knots On Various Loads

4) Firstly, the wire is inserted through a guided pathway which is made of polyethylene tube as shown in Fig.B-3. This tube is made up of curved required for making loop of knot mounted on metallic plate which is placed at the extreme front of the hollow shaft.

5) It is cut across the periphery so that the rotated wire could be easily pulled out of the tube.

6) On completion of this circular loop, the wire will enter a hook that is placed at the end of the loop. Then the front end of the wire is put into the hole made on extended shaft coupled with the piston of cylinder which would pass through the hollow shaft.

7) When the backward stroke given to the cylinder with the help of two way controlled valve the ideal stroke reaches the work.

8) Due to 60 N force, this backward stroke makes a sudden impact at a particular area of wire where the hook is attached gets pulled inside the hollow shaft. Therefore, the knot is formed with engaging the hook.

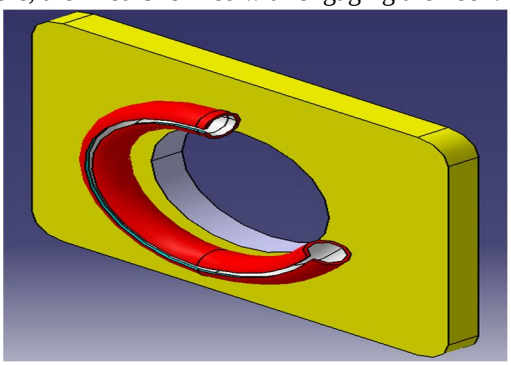

Fig.B-3. Guided Path Of PET Tube

V. CONCLUSION

Tying a knot with engaging the hook manually resulting – fatigue, less production rate & more time consumption. This project takes the liberty to design and implement an effective mechanism to achieve this specific task. However, the design must be a simple and cost effective mechanism. Therefore, this project is designed to develop a simple mechanism in order to fulfill the requirement.

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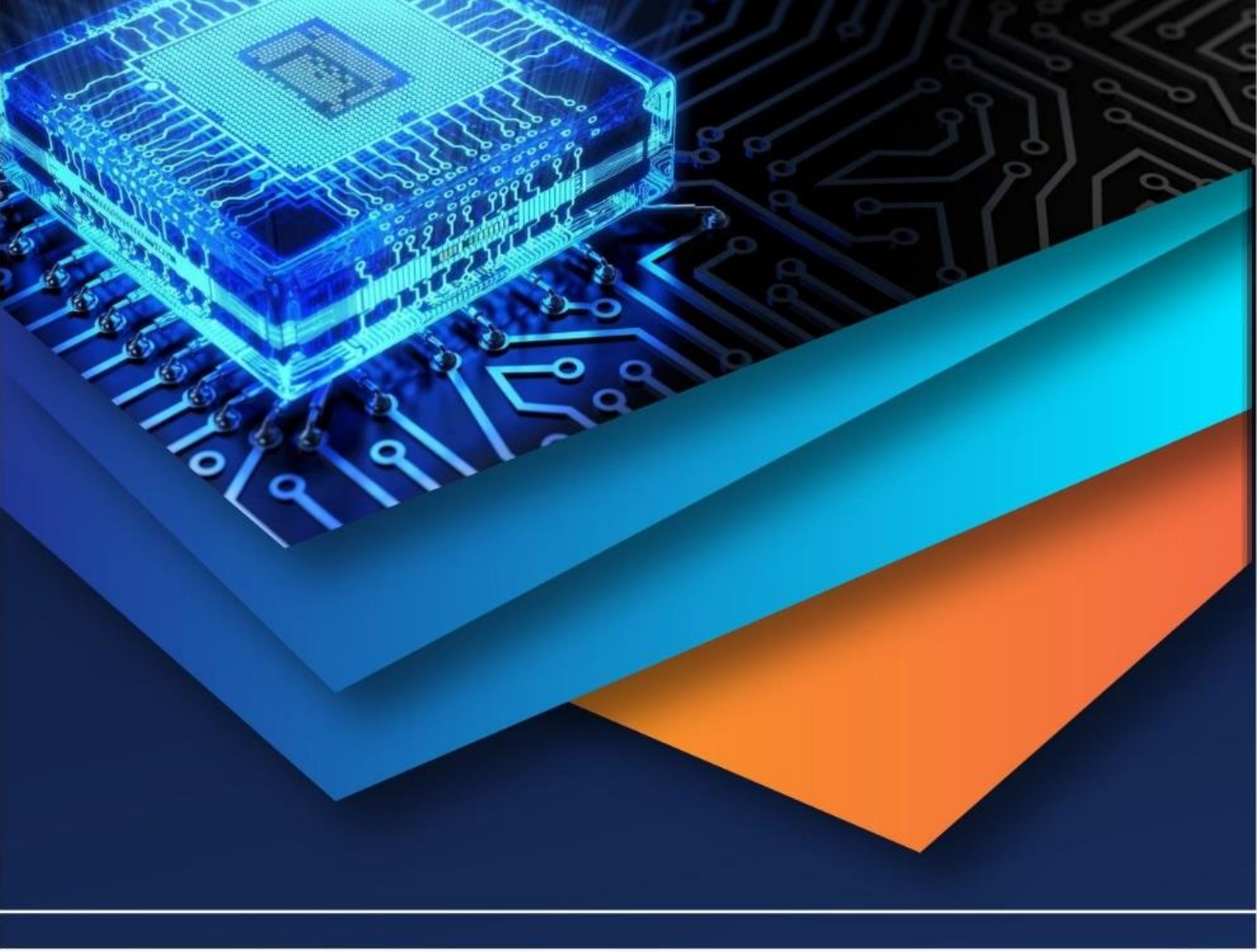

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