

Design and Development of Cost Effective Lanyard Printing Machine

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Abstract— A Lanyard is an essential part of preparing any company or Organization's office supplies or stationery. As an ID card holder, Lanyard lends repute and creditability to the organization. While a plain lanyard is certainly functional, a printed and customized one is bound to turn heads and leave a lasting impression. To get attractive, brand-relevant satin lanyards to give your company just the right kind of exposure it needs and if employees are participating in conferences and exhibitions, wearing a branded lanyard will help them increase brand awareness. The present work involved the design, development, and testing of a Lanyard Printing machine which overcomes the drawback of existing costly printing machines. The design and developmental stages include the gear and chain drive along with the rack and pinion method and their generation mechanisms. Details of a simple, sturdy, and efficient gear and chain unit, financially beneficial to laborers and producers are considered. The unit can print about 80 impressions per minute compared to 30 impressions per minute of existing machines.

Keywords— Lanyard, Rack and Pinion, Gear and Chain, Knurled Shaft, Lever

I. INTRODUCTION

When considering lanyards, the vast majority think about a string that you put around your neck to hold an event pass or ID identification. What's more, while that is perhaps the most widely recognized employments of lanyards today, lanyards aren't an innovation by any means.

Lanyards additionally serve one more vital capacity at events: Corporate Marketing. Organizations can undoubtedly utilize lanyards as an extraordinary promotional and showcasing thing by altering them and printing them with their logo.

As a thing that can be utilized for an assortment of capacities from holding ID identifications to keys, they are without a doubt perhaps the most helpful things to print your logo on for accomplishing further brand acknowledgment.

Nowadays automatic printing machines are available to print lanyards, but their costing and maintenance is high for an

ordinary small-scale printing press operator. This derives an inspiration for us to design and develop a cost-effective and reliable lanyard printing machine.

II. FIELD OF USE

This machine is useful to any organizations, printing entrepreneur and small-scale business aspirants. The machine can provide faster work rate and no electricity cost. This machine is expected to print minimum 50 lanyard per minute. It is useful to the printing entrepreneur by many ways. It is easy to operate, does not need skilled labor, rapid, safe operation, and simple maintenance. It can be easily assembled and can be carried from one place to another.

The cost of this machine is lesser as compared to the present available machines. Also, this available machine does not require electrical power supply and can be considered as eco-friendly machine.

III. PROBLEM STATEMENT

In Current lanyard printing machine, following are the main concern,

- Cost of machine
- Loss of power
- High maintenance
- Wastage of electricity

A. Design Objective

Build Lanyard printing machine with below objectives:

- Save energy
- Reduce maintenance cost
- No air & environment pollution
- Easy operation

IV. LITERATURE REVIEW

The historical backdrop of lanyard extends back to the 1500s when French troop and pirates utilized them to keep their weapons close nearby. [4]

A. The Beginnings of the Lanyard

French troops and pirates would utilize lanyards like this to guarantee that they didn't lose their weapons while they climbed the gear of their boats or occupied with battle. Indeed, the word lanyard comes from the French expression of "laniere" which means strap. Also, while, we're accustomed to seeing some extravagant lanyards today, the main lanyards were simply basic straps made of rope or cord found on board the boat and tied around a gun, blade, or whistle. Officers could even be seen utilizing lanyards to connect guns to their uniform all through World War II.

As time went on, lanyards were created with explicit connections which made it simpler to change out weapons, instruments and different articles making them utilitarian in both military and regular citizen life.

B. Lanyards in the Modern Day

While lanyards fill an exceptionally useful need today, they have likewise gotten substantially more beautifying. They are well known as a specialty and as a security gadget in the corporate world. For example, lanyard weaving turned into a famous specialty for French and American youngsters during the 1950's. As an art, lanyard weaving shows kids how to make complex knots, for example, the box tie, Chinese knot, triangle and butterfly knot, just as create manual ability. In France, the specialty got known as "scoubidou" and is referred to in the USA as "boondoggle".

In the corporate and occasion world lanyards are utilized to show an ID or access identification. They make it simple to keep up security at occasions and corporate locales in light of the fact that a noticeably shown pass permits others to see what people's identity is, the thing that association they have a place with and what level of access they have.

V. MACHINE DESCRIPTION

The Lanyard printing machine prints lanyards without electricity and with less printing cost. The lanyard is printed on a horizontal rectangular surface with a screen-printing machine. The lanyard is moved up by the conveyor mechanism. The top assembly comprises two driving panels at two ends of the rectangular plane. Two driving panels are then connected with the help of a gear and chain mechanism at one end and a rack and pinion mechanism at another end. The top assembly has one lever connected to a rack and pinion mechanism to rotate the shaft in a steady way for steady lanyard printing. Details of the complete mechanisms are explained in the working principle and methodology section.

The main parts involved in the project are driving shafts having knurling, gear and chain, rack and pinion mechanism, lever, conveyor, and printing panel.

The parts with their functionalities involved in lanyard printing machine are listed below. The uses of those parts in this machine along with the drawings are also explained. These parts are explained along with the dimensions as required for this machine.

A. Major parts

To introduce this mechanism to lanyard printing machine operation the main components that we have made use are

1) Gear and Chain Mechanism

Chain drive is a way of transmitting mechanical power from one place to another. The power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.[1] [4]

The size of the chain links must precisely match the size and spacing of the sprocket teeth.

The dimensions of the Gear and Chain used are listed below

The dimensions of Chain are

- Length of Chain : 110 cm
- Width of Chain : 1 cm
- Number of Pins : 64

The dimensions of Gear are

- Diameter of Gear : 4 cm
- Number of Teeth : 12
- Width of Teeth : 4 mm.

2) Rack and Pinion mechanism

A rack and pinion mechanism is a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack), which operate to translate rotational motion into linear motion. Driving the pinion into rotation causes the rack to be driven linearly. Driving the rack linearly will cause the pinion to be driven into a rotation.[4]

A rack and pinion mechanism is used when converting rotational movement to linear motion (or vice versa). A bar shaped gear with an infinite (flat surface) radius of a cylindrical gear is called a rack, and a meshed spur gear is called a pinion.[2]

The dimensions of the rack and pinion used are listed below

The dimensions of rack are

- Length of Rack : 40 cm
- Width of Rack : 1 cm
- Total Tooth on Rack : 140

The dimensions of pinions are

- Outer diameter of the Pinion: 25 mm
- Inner diameter of the Pinion: 12 mm
- Total Tooth on Pinion : 24

3) Knurled shaft

Knurling is a manufacturing process, typically conducted on a lathe, whereby a pattern of straight, angled or crossed lines is rolled into the material. The operation is performed for producing indentations on a part of a work piece. Knurling allows hands or fingers to get a better grip on the knurled object than would be provided by the originally smooth metal surface. Occasionally, the knurled pattern is a series of straight ridges or a helix of "straight" ridges rather than the more-usual crisscross pattern. [4]

The knurled rod is having a knurled finish instead of hexagonal or square edges to help in tightening or loosening the nut without the use of a tool. The knurled surfaces provide enough grip to hold the nut between the thumb and forefinger. Hence it is also called a thumb nut. It is mainly used on small-diameter bolts.

Close-up shot of a diamond-pattern knurling on a cylindrical work piece. Knurling method: left/right with tips raised, spiral angle: 30°, pitch: 1 mm, profile angle: 90°.

4) Conveyor system

In our system, we've designed and manufactured two conveyor rods to carry the lanyard in vertical motion to the printing panel. Two conveyor rods are having 6 rollers in each of them.

The dimensions of the Conveyor Rod are listed below

- Length of Rods : 24 cm
- Diameter of Rods : 35 mm
- Number of Wheels : 6 in each

5) Lever handle connection with Rack and Pinion assembly

Mild-steel lever is connected to Rack and Pinion assembly to lift lanyard from conveyor in a steady and accurate length. A rack and pinion is a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack), which operate to translate rotational motion into linear motion. Driving the pinion into rotation causes the rack to be driven linearly along with the shaft which will help to run complete assembly in synchronization.[2][4]

6) Seals, fittings, and connections

In general, valves have female threaded hoses for the fluid connection, and hoses have female ends with captive nuts. A male-male fitting is chosen to connect the two. Many standardized systems are in use. The seals play an important role in the systems, since the system does not work if there is any leakage in the joints.[3]

7) Rectangular wooden panel

This is made up of plywood of length 640mm and width 490mm and thickness of 20mm. Also, there are some cutting work is performed for fit the clamp, hand lever and the assembly of main working mechanism.

There is small frame is fitted to the panel to coupled it with the base body frame. The main purpose of this panel is to placement of the printing screen over the panel. On this panel we can fit the screen up to 200mm width and 350mm length of printing area.

8) Spring Loaded bolts and Bearings

A spring is an elastic object used to store mechanical energy. Springs are usually made of hardened steel. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication.

A Coil spring, also known as a helical spring, is a mechanical device, which is used here to store energy and subsequently release it, to absorb shock, or to maintain a force between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded. [1][4]

9) Mild-Steel Frame

Mild steel differs from stainless steel in its chromium content. Stainless steel contains a lot more chromium than ordinary carbon or mild steel. Mild steel is a type of steel alloy that contains a high amount of carbon as a major constituent.

We have used the angles and square tube of size 25x25x3 mm for fabrication.

VI. WORKING PRINCIPLE AND METHODOLOGY

This section outlines working principle, method of operation of the Lanyard Printing machine.

A. Working

This Lanyard Printing machine consists of a hand operated lever, which is connected to rack and pinion set. Pinion gear is meshed with the gear attached to the shaft, which perform the action of moving the lanyard. The rack displacement is adjustable with the help of one stopper, to provide flexibility for printing distance on the lanyard. Rack and Pinion is attached at the left side of the wooden panel. To speed up and maintain the balance, on the right side of the wooden panel gear and chain drive mechanism has been installed. With the gear and chain drive mechanism along, the excess friction and the force are eliminated. The power at the end of shaft is transmitted equally by Gear and chain drive mechanism to the rear shaft of the working mechanism.

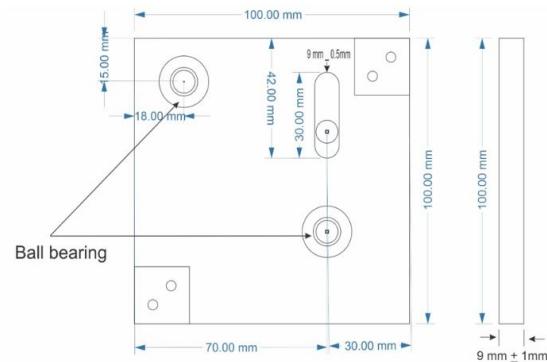


Fig. 1. Top View of the mechanism

On body frame, ladder like structure is designed to mount the lanyard rolls. The lanyard roll strip is then passed through the conveyor to the rear mechanism with the help of guide wheels. The guide wheels will help to move the strip in linearly to the front mechanism in vertical direction. The printing screen will be mounted at the top of the strip on the wooden panel with the help of clamp as shown in Fig. 1. A knurled shaft is mounted on the both working mechanisms are having pressures by spring loaded bolts. The spring-loaded bolts are further connecting with the pulley wheels to move the lanyard. The knurled shaft with pulley structure gives enough friction to the lanyard to move forward. When the printing action is performed, then the hand operated lever is pulled. With each pull from lever, lanyard strip moves forward with specific distance given to it for each printing impression.

B. Methodology

Most of the parts in this project are prepared by the lathe operation. Various operations like cutting, sanding, knurling, drilling is done using lathe. The shafts are turned on the lathe to get smooth and good surface finish. The pulleys are also turned to get good surface finish. Along with this drilling, milling, and shaping machines are also used for many operations. The Lanyard base holder assembly is cut and shaped by using milling and shaping machines. Different types of drilling machines are used to drill many holes for the seating of bolts and nuts. The drills are done on the links to connect different links each other. The holes on the height adjuster are made by using drilling machine. Most of the parts are given good and smooth surface finish by using shaping machine and by polishing.

The main operation done on this machine is the welding. All the parts are joined by welding process. The welding

methods used here are arc welding. All the separate parts are assembled by arc welding process. And some spot welding is also done by spot welding process. The links and some other parts are joined by the bolts and nuts.

VII. RESULTS AND ADVANTAGES

This section reviews about the results of Lanyard Printing machine along with the advantages are to be briefed.

A. Results

The Lanyard Printing machine prepared by us is operated by gear and chain, rack, and pinion mechanisms. This machine can print 2 roles of lanyard at a same time with 100 print impressions per minute. The materials used in this machine are of good quality and durable. And the parts are painted to prevent from rusting. Most of the parts are made from mild steel material and springs are made of spring steel material.



Fig. 2. Top View of the machine

The machine has the capacity to print the Lanyard of any shape and size. The manually applied force is very less on the handle. As it is not utilizing any electricity, it helps to reduce total production cost.

B. Advantages

- Less Production costing
- Compact in size, portable.
- Less Maintenance and machine cost (compared to automatic machine)
- Eco-friendly (No Electricity Cost)
- It is user friendly, rapid and can be operated safely.
- Can be conveniently assembled.
- Can be operated by anyone regardless of age.

- Does not require lengthy training for the operation and the machine can be understood easily
- Print Impression about 900 to 1000 Lanyards per hour.

VIII. CONCLUSION

In this modern world the time and cost have more weightage for every operation. So, to overcome this concept we have designed and fabricated the machine named "Lanyard Printing machine" to reduce the cost and to save electric energy. By viewing many types of machines like manual, traditional, electronic, and other, so we conclude that current machine is manufactured keeping less cost in mind.

This machine has many advantages over other machines. The time consumed by this machine is little more. If we increase the conveyor number and driving shaft, we can print quickly about minimum three to four Lanyards roles per stroke. Machine can be operated efficiently unskilled labors. In this project we have used very durable and strong machine parts to eliminate the regular maintenance. We conclude that this machine is more useful to the printing entrepreneurs and the small-scale industry where the large numbers of Lanyards are to be printed.

A. Future Enhancement

- By inserting conveyor and wheels in driving shaft, number of lanyard roles per stroke can be increased to 3 or 4 at a time.
- By inserting motors for the lever operation, the machine can be automated.

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