

Design Of Automatic Pvc Pipe Cutting Machine

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Abstract

Cutting the PVC pipes of finite length manually will not yield a good result. So the present work focused to design and develops the machine which will cut the material automatically of finite length according to the requirements. The work mainly focuses on design and manufacturing of PVC cutting machine. Cutting of PVC pipes with minimal human efforts is a challenging job. The main objective of this work is to cut the pipe in less time with minimal burr produced around the pipe, to make it cost effective and easy to use. By considering these constraints and objectives, the design is focused on a unit which cuts the pipe automatically with very less human efforts. In this design working of machine is mainly depend on control circuit i.e, when actuated by the button, the control circuit connects the clamping motor to clamp the pipe, at the end of the clamping a micro switch will trigger the cutter motor that moves down and also cuts the pipe. At the end of the stroke the micro switch actuates that will lift it back and unclamp the job by the moving clamp retracting back the motor. The end of this action resets and stops the machine.

Keywords: *Automatic cutting, Efficiency, Cost effective, Clamping.*

1. Introduction

In today's world products are required to be produced on mass scale which, ultimately reduce the production cost. For that purpose different techniques are developed. Today, automation has powerfully entered in the industrial manufacturing process in order to get identical and accurate dimensions of each product by reducing the human involvement. Automatic production is carried out for mass production which aims at reducing the manufacturing cost of a product. Automatic pipe cutting machine is one of such machine used for mass production and aim at reducing the human involvement in order to increase the productivity and accuracy of the product [1].

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project work is to design and develop the machine which will cut the material automatically of finite length according to requirements.

The primary concern of this system is to carry out three operations: Feeding, Clamping and Cutting. The sequenced operations of the system must be precisely timed. The major work of this system is to slice out large number of jobs in rod or pipe form according to the batch production. The selection of cutter is based on the stress calculated considering the pipe or rod material. The material preferred in this system is a PVC (polyvinyl chloride) pipe for demonstration. But mild steel rods and pipes also be worked out by using different cutters specifications. The cutter to be used in the machine system has been considered by calculating the torque required for cutting PVC object by help of the design data available. With the help of this system the time required to slice the objects like the pipe or rod will be less the accuracy of slicing or cutting of the material will also be improved. The system can be handled by semi-skilled operators with ease. [2]

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The cutting and clamping mechanism developed for this machine to cut the pipe should be able to meet some important objectives. Primarily the time consumed for cutting operation must be less. The device should be user friendly. It should be versatile to cut pipes of varied lengths and sustain pressure while cutting thick pipes. The device should be handy, portable and durable, with anti corrosion property. Apart from all this the device should be economical, such that people should buy at low cost.

2. Literature survey

P.Balashanmugam and G.Balasubramanian [3] proposed a method in which advancement of the cutter is carried out in the upward and downward direction using pneumatic double acting piston and cylinder unit arrangement, along with the foot operated direction control valve (DCV). In this type of machine high pressure air is used as working fluid for the transfer of power and the motion. The invention compressed air from the compressor is used as the force medium for this operation. There are pneumatic double acting cylinders, direction control valve and flow control valve. The arm from the compressor enters to the flow control valve. The controlled air from the flow control valve enters to the DCV. The function of DCV is to enter the air into the pneumatic cylinder. The present work involves the use of 5/2 DCV. In the first position air enters into the cylinder and pushes the piston, so that the cutting stroke is obtained. In the next position air enters into the other side of cylinder and pushes the piston return back, so that the releasing stroke is obtained. Shital K. Sharma et.al [4] have provided an alternative to the existing automatic PVC pipe cutting machine, in terms of automating the pipe entry into the cutting apparatus, This method eliminates power fluctuation and lesser initial investment. There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as shafts, bolts, screws, etc. The clamping arrangement can be varied according to need of operations suitable. The overall system is compact in size, light weight, modular and flexible to be used in small work jobs which need batch production. The system even has the potential to add up a PLC system to control its overall working with ease and with less effort. This system has the potential to adopt higher level of automation if desired in future. Pandit Mandar Bipinchandra et al. [1] have suggested that automatic pipe cutting machine has been used for mass production and aims at reducing the human involvement in order to increase the productivity and accuracy of the product. Automatic pneumatic pipe cutting machine uses a pneumatic circuit for cutting of PVC pipes which, ultimately reduces the total time required for the complete cutting operation and increases the production rate. Nimbalkar Shripad, Velanje Sagar, Patil Abhay and Varpe Pooja [5] have conducted invention related to pneumatically operated automatic pipe-cutting machine. The arrangement of the pneumatic valves deployed in this system is accordance to the circuit was planned. The choice of cutter is based on the stress calculated keeping in mind the pipe or rod material. The material favoured in this system is a PVC (Polyvinyl Chloride) pipe for demo.

But mild steel rods and pipes can also be worked out by using diverse cutter provisions.

3. Present work

In the present design the clamping of pipe is done by rack and pinion mechanism and the cutting operation is done by DC motor which is controlled by control circuit that will cut the pipe automatically. Feeding is done manually. If the need is to cut the pipes of constant length stopper can be fixed at specified lengths and thereby increasing the productivity.

Schematic diagram of pipe cutting using rack and pinion mechanism is as shown in the below figure 1. The cutter motor is held rigidly in the holder and the holder is welded to the shaft of the driven gear. The driven gear is externally meshed with the driver gear and the driver gear is driven by DC motor. Rack and pinion mechanism is used for clamping the PVC pipe. IC circuits and limiting switches are used to control the sequence of operations.



Figure 1 SET UP OF PIPE CUTTING USING RACK AND PINION MECHANISM

4. Design details

In the present design clamping and cutting are automated with the help of limit switches. The important mechanisms used are clamping of pipe, cutting of pipe, automatic retraction and unclamping of pipe. For a particular length of pipe the stopper is fixed which is attached to base. The automatic clamping and unclamping of the pipe is done using rack and pinion mechanism which is run by a DC motor. Motion of motor assembly is

achieved by gears which are driven by DC motor. The cutter is made to rotate by 2000 rpm motor.

In the final design all the mechanisms are controlled by limit switches. The CATIA model of the designed set up of machine is as shown in figure 2. It also contains control circuit which makes the design

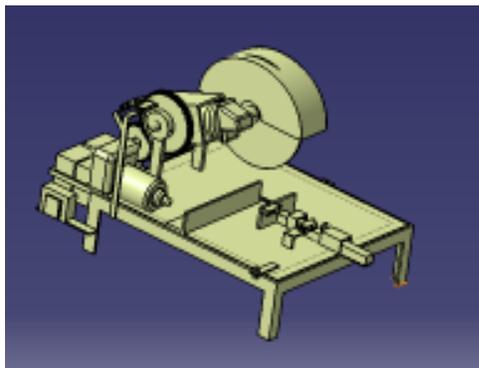


Figure 2 CATIA MODEL of the machine

automatic. The electric circuit contains resistors (1k, 2k, 10k, 15k) ohm, Capacitor 100 micro farad, IC-UM606, IC CD4017, transistor, relay, limit switches, push button (on/off), power supply.

The design of electric circuit is done in such a way that all the mechanisms are run sequentially. It contains the 6V rechargeable batteries which supplies constant current to the electric circuit and DC motors. The rated power for the design is 1380 Watts. The minimum torques needed to cut the PVC pipe is calculated as 18.40 N-m.

5. Advantages

1. It can cut the PVC pipes in less time.
2. It can sustain for thicker pipes.
3. User friendly and safety for user.
4. Surface finish produced is high with minimum burr produced.
5. Eco-friendly in design, portable and durable.
6. It can be used to cut the wood and metallic pipes by using high strength cutter wheels.
7. The design is cost effective and affordable.

6. Conclusion

Cutting the pipes manually will not yield good result like low surface finish produced, low accuracy of cut

etc. It is also a time consuming process. The machine developed in this present work is capable of clamping the pipe and cut the pipes automatically.

The machine can cut the pipe with minimum burr produced around the pipe, and it is cost effective and easy to use. This design can sustain thicker pipes and can cut the metallic pipes by using the cutter wheel of higher strength. Since the design is semi-automated the human intervention required is less and hence it is worker safety.

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