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"DESIGN & FABRICATION OF SENSOR BASED AUTOMATED CUTTING MACHINE"

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ABSTRACT - This is an automation based cutting process, it consists of cutting of bar at certain distance. Bar, pipe or any shape pipe can be cut by using this machine without more effort and saving valuable time in manufacturing process. This machine has automatic clamping. Now days, there are wide verity of wire products like welding electrode, weld mesh, heat treated kitchen baskets, automobile spark plugs and exhaust valves etc.

For manufacturing all above products, wire is used as primary element and is to be straightening from coil form. Now straighten wire is to be cut into wire rod as per required length. For these sequential operations, wire straightening cutting machine is used. Now days, conventional type wire straightening cutting machine are being used in which wire is cut by stopper cutter head which is limited by its length as well as feeding speed.

This machine can be widely applied in almost all type of industries. The pipe cutting process is a main part of the all industries. Normally the cutting machine is manually hand operated one for medium and small scale industries. In our project is pneumatically operated Typical Pipe Cutting Machine. Automation in the modern world is inevitable.

Any automatic machine aimed at the economical use of man, machine, and material worth the most. In our project is hand operated D.C valve and flow control valve is used for semi-automation. The pipe cutting machine works with the help of pneumatic double acting cylinder.

Keyword : **Pipe Cutting machine1, Pneumatic Cylinder2, Atomation3, Sensor4, Flow Control Valve5 1, Direction control valve1.**

INTRODUCTION - Our wide range of tube and pipe cutting machines includes machines that can handle small or large diameter tubes and that can be equipped with power hacksaw. We supply pipe cutting machines for round, elliptic or conical pipes as well as fully automated equipment featuring integrated logistics, or simpler, mobile versions.

Pipe cutting machines are popular in offshore, pipe processing, ship building, pressure vessel, structural and mechanical contracting manufacturing because of the complex cuts and profiles typical required in their respective industries. Pipe cutting, or pipe profiling, is a mechanized industrial process that removes material from pipe or tube to create a desired profile. Typical profiles include straight cuts, mitres, saddles and midsection holes.

OBJECTIVE

1. Reduce cost of automation.

2. To increase productivity, save time and energy.

3. Feeding pipe and circular rod automatically.

4. Job feeding takes place during return stoke of the machine there by reducing the idle time further..

5. Automatic clamping and decamping by using sensor.

6. Minimal human intervention only limited to replacing the bar stock on to the machine.

PROPOSED WORKING

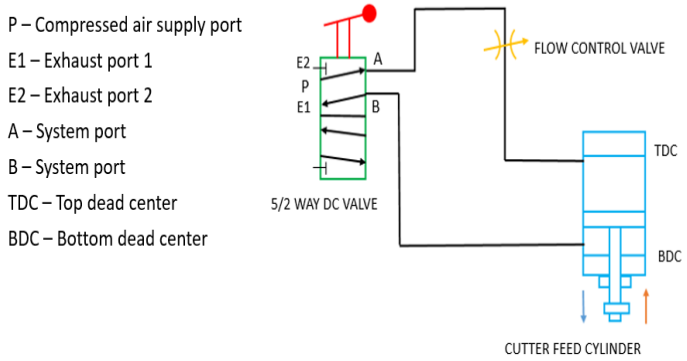
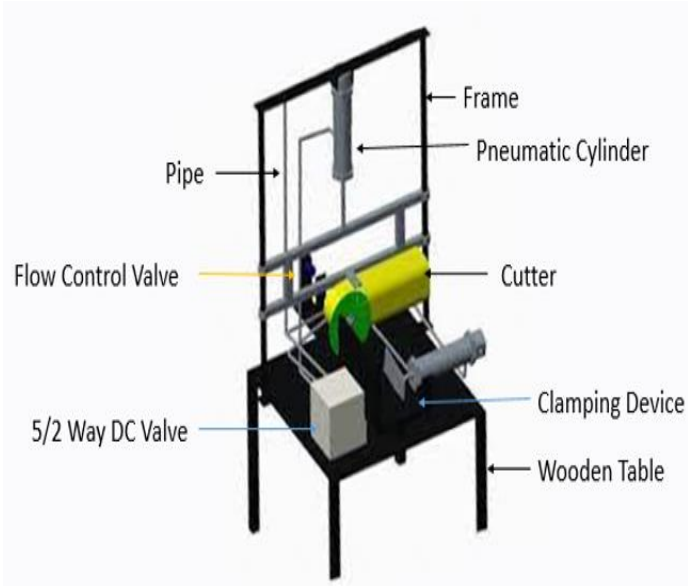


Fig Pneumatic clamping mechanism

A) CUTING STROKE - In first position of 5/2way DC valve, compressed air flows from P to A and B to El this flow is through flow control valve, the flow is controlled hence piston extends slowly and cutting stroke is complete.

B) RETURN STROKE- In second position of 5/2way DC valve, compressed air flows from P to B and A to E2 and then piston retracts at higher speed to save the time.



METHADOLOGY

[1] **Cutter motor**: Cutter motor is 100 watt motor variable speed 0 to 8000 rpm. The feeding action is done by a double acting **pneumatic cylinder** speed of the piston in forward direction i.e, the cutter feed is controlled flow gradual cutting action using a flow control valve in circuit.

[2] **Job clamping and guide arrangement**: Job is guided in the job guide whereas the clamping is achieved using a set of clamps. whereas the movable jaw is connected to another pneumatic cylinder which is operated to the cutter feed cylinder.

[3] **Job Feeding and sensing arrangement**: For the semi-automatic version of the machine the feeding action is manual i.e. the job is feed in the job guide manually upto stooper., the proximity sensor is used to sense the job.

[4] **Proximity sensor and electrical circuit**: Proximity sensor and the electronic circuit is a simple electrical circuit used to sequence the operations in the circuit.

[5] **Pneumatic circuit**: Pneumatic circuit uses double acting pneumatic cylinders, one 5/2 way direction control valve and one flow control valve., functions of the above components have already being explained above.

DESIGN ANALYSIS --

Torque Analysis -

Torque given by spindle

$P = 2\pi NT/60$

Where,

P – Power in **watt**

T – Torque given by spindle in **N-mm**

N – Revolution of cutter in **rpm**

$T = 850x60/2\pi x11000$

$T_{act} = 0.7379$ N-m

$\mathbf{T_{act} = 737.9}$ **N-mm**

Consider 25% overloading

$T_{design} = 1.25 \times T_{actual}$

$T_{design} = 1.25 \times 737.9$

$\mathbf{T_{design} = 921.25}$ **N-mm**

As material used for shaft is E24 i.e. Alloy Steel

6_{ut} = 800 N/mm^2

6_{yt} = 680 N/mm^2

$6_{working}$ = 112 N/mm^2

F_s = 56 N/mm^2 Reff :- Machine design by R S Khurmi

F.O.S. = $6_{ut}/6_{wo}$

F.O.S. = 7

Design of Spindle

T = (π/16) x Fsxd^3

921.25 = (π/16) x 56 x d^3

d = 4.37

checking for shear stress

T = (π/16) x Fsxd^3

921.25 = (π/16) x Fs x 4.37^3

Fs = 56.22 N/mm^2>permissible shear stress

So, design is unsafe

Now, consider diameter of spindle **d = 8mm**

T = π/16 x Fs x d^3

921.25 = π/16 x Fs x 8^3

Fs = 9.16 N/mm^2<permissible shear stress

So, spindle is safe under torsional load

Shear stress in threaded end due to axial load :-

Piston rod threading end = M4 x 0.8 pitch

Fs_{act} = w/π n dc t

t = width thread at root = p/2

t = 0.4 mm

n = no of threads in contact = 12/1 = 12

$$fs_{act} = \frac{50}{\pi * 12 * 5.35 * 0.4}$$

fs_{act} = 0.6197 N/mm^2

As ; fs_{act}<fs_{all} , the screw threads are safe in shear.

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