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DESIGN AND FABRICATION OF PNEUMATIC OPERATED CHAIN MAKING MACHINE

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Abstract - *This paper relates to semi-automatic chain making machine used for Square link chain production. The preferred embodiment of project comprises a double acting pneumatic cylinder, compressor, die, punch, hose pipes and base plate. The punch is attached to the pneumatic cylinder. Then the pneumatic cylinder is connected to the compressor with the help of hose pipes. The die is re-attachable for the variation in size of resulting chain. The pneumatic cylinder is mounted on the base plate. Chain size may be varied by changing the punch and die. As the diameter of chain increases, the size of the pneumatic cylinder has to be changed. As the chains are generally used for lifting purposes, it must have strength. The material which will be used for chain making is plain carbon steel as it has high tensile strength property and is corrosion resistant.*

Key Words: **Square link chain, Compressor, Die, Punch, Double acting pneumatic cylinder, Hose pipes.**

1. INTRODUCTION

When most people hear the word "chain" they imagine a short link chain, which consist of connected metal rings, or the type of chain used on a motorcycle or bicycle. However, chains of every size and description are used in factories, even though are rarely seen in daily life. In fact most people probably don't notice that chain is being used all around them in parking elevators, locking purpose, galvanizing plant, material handling, etc.

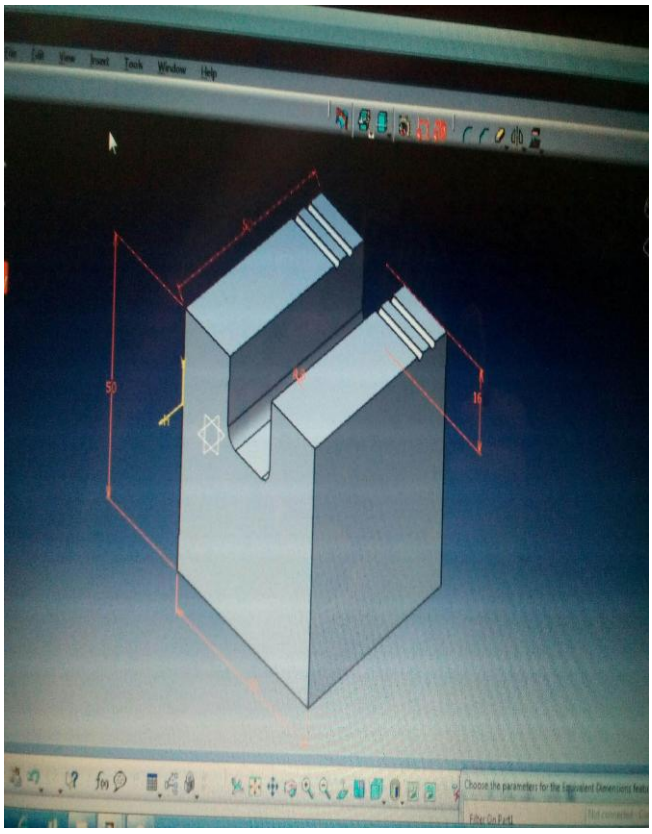
The objective of the project was to eliminate the complicated mechanism of existing automatic chain making machine used to make square link chain to the simplest mechanism possible. Another objective was to reduce the cost for manufacturing square link chain making machine. Existing automatic chain making machine is very large in size and has lots of mechanical linkages and complicated mechanism and also the machine is not flexible for changing size of chain and it is only suitable for mass production. To overcome these problems we have conceptualize the design of pneumatic operated chain making machine.

1.1 Components

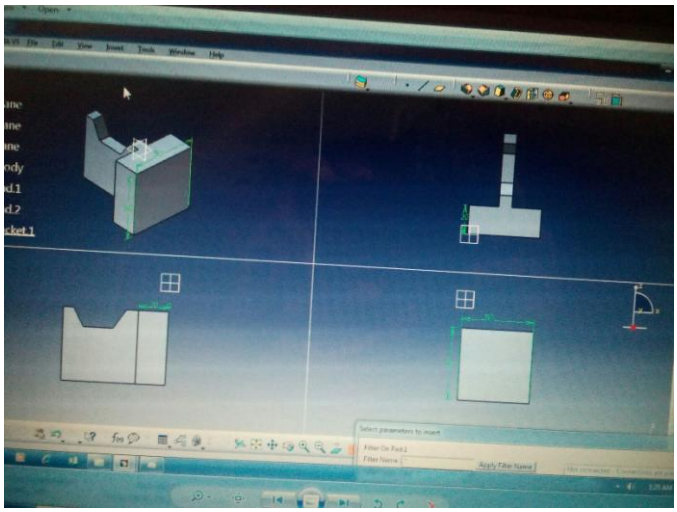
- Compressor
- Double acting pneumatic cylinder (100x50)mm
- Direction control valve 5/2 DCV
- Die and punch
- Hose pipes
- Base plate
- Rod (Plain Carbon Steel)

1.2 Design

- Die



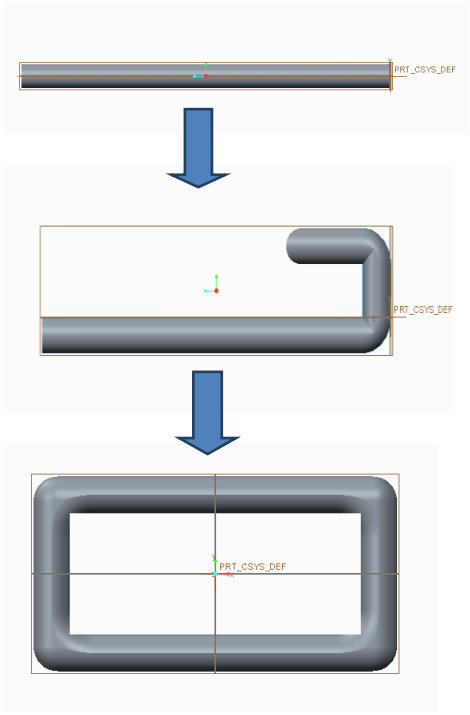
Punch



2. Working

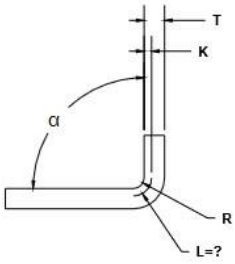
The Working of our project "**PNEUMATIC OPERATED CHAIN MAKING MACHINE"** is quite simple. Compressor is switched ON, compressor draws air and store in storage tank. And with the help of foot control valve the air is further send to the double acting pneumatic cylinder due to which punch gets pushed further. Plain carbon steel of calculated size is placed in front of die of required size. The punch presses plain carbon steel rod into die and make the plain carbon steel rod in J shape. Further the rod is first inverted and then rotated manually and then placed in front of die and foot valve is pressed. The second time when punch presses it help to make a link. Similarly other steel rod is to be used and formed J shape and fixed into the previously made link ,till then second time punch presses the second rod and two links are formed connected. Similarly chain of varying size and length can be formed by changing die and punch.
As the material diameter increases, the size of pneumatic cylinder has to be varied. The material which we are going to use is plain carbon steel, as it is corrosion resistant and has a high tensile strength which hence this material is more suitable

The following figure shows the sequence of formation of square link:-



3. CALCULATION

3.1 For calculating the length of rod for making square link chain of size (26x16) mm



a) Bending allowance

L= α(R+KT)

Where,

α = 90° (1.57 rad)

R- Radius of bend = 1.5 mm

K- Bending factor (k= 1/3, if R<T, K= 1/2, if R>T)

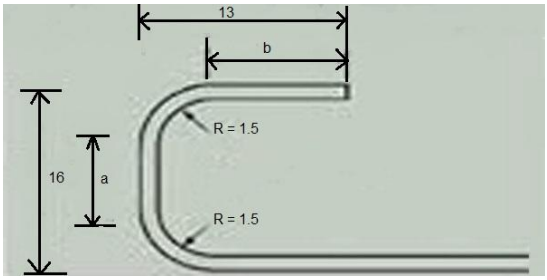
T- Thickness of rod = 3.15 mm

L= 1.57(1.5+3.15/3)

L = 4 mm

b) Length of rod required (L.R)

L.R = 2(a+2b+2L)



Where, a= 16-2(3.15+1.5) = 6.7 mm

Similarly b = 13-(3.15+1.5) = 8.35 mm

Therefore L.R = 2[6.7+ (2x8.35) + (2x4)] = 62.8 mm

3.2 Force and pressure calculation for bending rod

Diameter of rod d = 3.15 mm

Selecting material of rod

From Data Book (page 39)

IS C-40 Annealed (SAE1040) Plain Carbon Steel.

Properties: Sut = 632 N/mm^2, Syc = Syt = 350 N/mm^2, Sys = 210 N/mm^2. E = 203 GPa, G= 78 GPa, BHN = 180

SELECTING FOS (Factor of Safety)

From, Design Data Book (page 25)

Here, dynamic with medium Shock Load is Applied

Selecting **FOS =2** (For Reciprocating Engine, Machine Tool, compressors)

Now, in our case Permanent deformation occur,

Permissible stress = Sut/FOS

Permissible Stress =632/2= 316 N /mm2

a) Calculate Force (F)

Force = Stress *Area of Rod

= 316 * π/4*(d^2)

Force = 2462.62 N

b) Calculating Pressure (P)

For this Application ,We are Selecting 100 mm diameter of cylinder (Double Acting Pneumatic Cylinder)

D=100 mm

As we know,

Force = Pressure*Area of pneumatic cylinder

2462.62 = P * (π/4 * D^2)

Therefore pressure P = .313 MPa = 3.13 bar

4. Conclusion:

There are many aspects of the design which needs further modification like we need to increase its productivity and also the time required for manufacturing the chain. Though this mechanism is innovative in its own respect, still it has scope to elaborate the mechanism and can be studied further for obtaining better results.

REFERENCES

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[2] JR Machinary associates
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