Design of Pneumatic Toggle Press

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Abstract-*Many machines today are using of electrical, hydraulic and pneumatic component as a source of system. So, to gain skills and knowledge on how to develop machine, this project are recommend.For pneumatic circuit, software has been used which is required to see the process of machine before it implemented. For fabrication pan, the machining process are only used conventional machine; milling machine and lathe machineThis project are also provided to familiarize the student about the technology on sheet metal forming which is used pneumatic concept yet has rapidly grown especially in the automotive and electrical industry. Furthermore, the strong concern is to obtain better product quality with lower cost.*

Keywords-Fabrication pan,lathe machine, milling machine, pneumatic circuit, toggle

I. INTRODUCTION

In this machine use toggle mechanism, combination of Solid,usually metallic links, connected by pin joints that are so arranged that a small force applied at one point can create much larger force at another point.The press is the punching and bending machine tool designed to punch metal plate by applying mechanical force or pressure. The metal is punched or bends to the desired requirement. The presses are exclusively intended for mass production and they represent the fastest and more efficient way to form a metal into a finished punched or bend product. Press tools are used to punch and bend thin metals. Press tools operation can be simplified to a few simple operations involving a punch and die. There are Nemours types of presses in Engineering field which are use to full fill the requirements

II. DESIGN AND MANUFACTURING

To design a press machine having capacity of 1 ton force, 1.2 ton force is considered to neglect the effect of losses such as frictional loss, leakage loss, etc.

Step 1: To convert 1.2 ton into Newton.

We know that,

1 ton = 9810 N

1.2ton = 11772 N.

Step 2: To decide the air pressure

Generally, the pressure of air used in pneumatic circuit is 6 bar, so 5.5 bar air pressure is used for deign calculation.

Step 3: To convert 5.5 bar into N/mm^2

We know that,

1 bar = $1*10^{-1}$ N/mm^2

5.5 bar = 0.55 N/mm^2

Step 4: Force calculation: -

Total force = force applied by the air (F) + inertia force (F_i)

A] To calculate force acting on a toggle: -

Force applied by air on a toggle = pressure of air * area of toggle on which air pressure is acting

$F_a = Pr * A$

Area = Length of toggle * height of toggle

$A = L * h$

$A = 146 * 25$

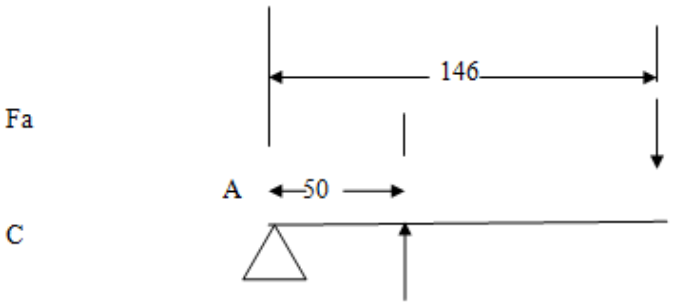
$A = 3650$ mm^2

$F_a = Pr * A$

$F_a = 0.55 * 3650$

$F_a = 2007.5$ N

Consider toggle as a lever



$F_a * AC = F * AB$

$2007.5 * 146 = F * 50$

F = 5861.9 N

=5862 N

B] For calculate the inertia force (F_i):

Inertia force calculation data:

- Length of connecting rod (l) = 50mm = 0.05m
- ½ stroke length (r) = 30mm =0.03m
- Angle of toggle to it's with vertical axis (θ) = 12.5^0
- Total mass of mechanism (m) = 3 kg
- Speed in rpm (N) = 2000

n = l/r

= 0.05/0.03

= 1.67

Speed in rad/s (w) = $2 \pi N/60$

= $2 * \pi * 2000/60$

= 209.43 rad/s

$F_i = m * w2 * r (\cos \theta + (\cos 2\theta /n))$

$F_i = 3 * (209.43)^2 * 0.03 * (\cos 12.5 + (\cos 25 /1.67))$

F_i = 5996.20 N

F_i = 5997 N

Total force = F + F_i

= 5862 + 5997

= 11859 N

Step: 5 To calculate number of bolt

A] To calculate the force acting on side plate

Area = $(\pi r^2)*(¼)*2$

A = $(\pi (146)^2)*(¼)* 2$

A = 33483.09 mm^2

Where ,

- R = length of toggle
- ¼ = because of quarter circle
- 2= because of two side plate

Force =pressure * area

= 0.55 * 33483.09

= 18415.70 N

For threaded component the force is taken as 1.3 times of actual force in design

F_d = 1.3 * 18415.70

= 23940.41 N

To find out the number of bolt (n)

$F_d = ((\pi/4) * d^2)*(n)*\sigma t$

- d = dia of bolt

$23940.41 = (\pi/4) * 6.5^2 * n * 60$

n = 12.02

n = 13

III. CONCLUSION

Now we know that pneumatic punching press is very cheap compared to hydraulic punching press machine. We can do simple operation like piercing, stamping, bending, riveting, blanking, etc. It compact size having less weight, required less working area, easy maintainance.

It can be concluded that in case press machine design it is first important to know design requirement like material strength and availability, required pressure, space, dimension of machine. The further advantage of the system has safety to operator, made operation more convenient, improved dimensional and positional accuracy.

Based on the shear provided on the punch face the punching force reductionof 25% to 60% thereby increasing tool life and reducing tool machining cost. Therefore with this force reduction we are able to easily punch sheets of thickness upto 2.25 mm for plastic sheet having tensile strength 90 N/mm2 and upto 1.5 mm of aluminium sheet having tensile strength 180 N/mm2.

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