STUDY ON MANUFACTURING PNEUMATIC JACK SYSTEM

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Abstract - The bump/jack stops act as a secondary suspension system. This system was designed to protect your truck from those unforeseen hits when pushing the limits of the suspension. All of the energy used to compress the bump stop is dissipated as heat thus preventing the suspension from bottoming out , leaving everything still in place on your dash. Also, the rebound of the bump stop is designed to extend at a slower rate which will keep from forcing the axle back up, which would cause the suspension to bounce back. By slowing down the last couple of inches of compression travel, you reduce the amount of stored energy that needs to be controlled on the rebound side. This will help maintain control of the vehicle when off-roading at speed.

1. Introduction

The standard vehicle jacks require the operator to retrieve the jack from the trunk, place it under the vehicle in the proper location, and then manually rotate the screw thread in order to lift the vehicle. This process is time consuming, physically demanding and poses several safety hazards. Adverse weather conditions can exacerbate the process and make it a greater safety hazard. Those who are physically weaker (women, senior citizens, young drivers) may face great difficulties in jacking a vehicle in case of an emergency repair. The purpose of this senior design project is to counter the safety hazards and physical demands related

to using manual jacks or aftermarket hydraulic jacks by designing a jack system that is permanently attached to the vehicle. This vehicle mounted jack system will be automated so that operator input is kept to a minimum and thus safety hazards can be avoided.

Pneumatics, from the Greek (pneumatics, coming from the wind) is the use of pressurized gases to dowork in science and technology.

Pneumatics was first documented by Hero of Alexandria in 60 A.D., but the concept had existed before then. Pneumatic products represent a multi-billion dollar industry today. Pneumatic devices areused in many industrial applications. Generally appropriate for applications involving less force than hydraulic applications, and typically less expensive than electric applications, most pneumatic devicesare designed to use clean dry air as an energy source. The actuator then converts that compressed air into mechanical motion. The type of motion produced depends on the design of the actuator. Pneumatics is employed in a variety of settings. In dentistry applications, pneumatic drills are lighter, faster and simpler than an electric drill of the same power rating (because the prime mover, the compressor, is separate from the drill and pumped air is capable of rotating the drill bit at extremely high rpm). Pneumatic transfer systems are employed in many industries to move powders and pellets. Pneumatic tubes can carry objects over distances. Pneumatic devices are also used where electric motors cannot be used for safety reasons, such as mining applications where rock drills are powered by air motors to preclude the need for electric motors deep in the mine where explosive gases may be present.

Pneumatic cylinders are generally less expensive than hydraulic or electric cylinders of similar sizeand capacity.

Types of shearing Machine:

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Shearing machines are classified according to the following:-1) Pneumatically operated
2) Hydraulically operated
3) Rack and pinion operated
4) Spring operated
Brief description of all the types are as follows.
1). Pneumatically operated:-

Here the advancement of the header is carried out in the upward and the downward direction using

the pneumatic double acting piston and cylinder unit arrangement along with the foot operated direction control valve. In this type of machine high pressure air is used as the working fluid for the transfer of power and the motion
2). Hydraulically operated:-

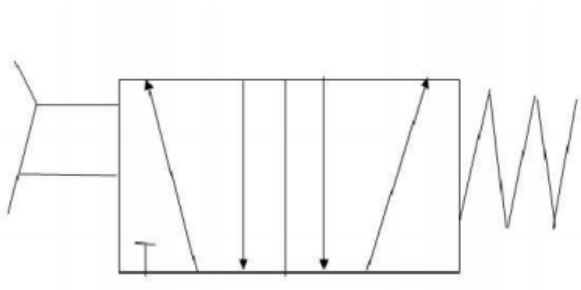
Here the lowering and raising of the header is carried over using the hydraulic piston and cylinderarrangement. To actuate the piston and cylinder, the oil is allowed to enter the cylinder from front or the back side of the piston. But the oil is comparatively costlier and its leakage may cause so many problems.
Rack and pinion operated:-

Here the lowering and the raising of the header is carried out manually using the rack and pinion arrangement. In this case the required pressure is applied manually using direct hand pressure on therack using pinion and lever arrangement. Since the machine is robust and requires large pressure,Hence it is not suitable.
Spring operated:-
The working of spring operated machine is similar to the rack and pinion operated machine but differsfrom it in construction. Here the lowering and the raising of the heating handle is carried out manuallyand it requires too much pressure for its operation and also there is possibility of having damage to thework piece if not handled carefully.

2.COMPONENTS OF PNEUMATIC SHEARING MACHINE :-

Different components of pneumatically shearing machine are:-1) Shearing blade 2) Pneumatic cylinder 3) 5/2 Direction control foot operated valve 4) Air circulating devices 5) FrameDouble acting cylinder:-Here we have used double acting cylinder. It is the pneumatic actuator, whichis actuated using compressed air. The Force exerted by the compressed air moves the piston in twodirections in a double acting cylinder. In principle, the stroke length is unlimited, although buckling andbending must be considered before we select a particular size of piston diameter, rod length and strokelength.
The double acting cylinder consists of
1) Cylinder tube,
2) Piston unit,
3) Double cup packing on piston, rod packing of O rings,
4) Bronze rod guide,
5) Piston rod,
6) End covers (flanges)
7) Port connection,
8) Cushion assembly.

The cylinder is manufactured from aluminum solid bar with central bore on lathe machine. It is thenmade smooth internally using method of honing and lapping. It contains piston and piston rod, whichreciprocates to and fro with the application of high pressure air. The piston is fitted with the pistonring which is made of Teflon rubber to make perfect compression of the air. 5/2 Direction control footoperated valve:



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2. Literature Review

The formation of any business begins with someone producing the initial idea for the project. Thecontinued success of an established business depends upon the number and quality of the ideas fed intoit. Without a continual flow of new ideas, a business cannot function profitably or expand successfullyand must, therefore eventually fade into total obscurity.

Ideas for a new business project, a new product, a means of reducing manufacturing costs, or forsolving industrial labour problems, begin in the human mind. Most people conceive their ideas unconsciously, and because they are unaware of the mental mechanics that caused the 'idea' to be produced,they cannot repeat the ideation process to produce further profitable ideas at will.Fortunately, there are available established creative techniques which, when used correctly, do enablea person to produce a large number of first-class ideas at will. One such creative technique, and probablythe most widely used in American industry, is 'brainstorming'.

In shearing operation as the punch descends upon the metal, the pressure exerted by the punch first cause the plastic deformation of the metal. Since the clearance between the punch and the die is verysmall, the plastic deformation takes place in a localized area and the metal adjacent to the cutting edgesof the punch and die edges becomes highly stressed, which causes the fracture to start on both sides ofthe sheet as the deformation progresses and the sheet is sheared.

2.1.1 Advantages

- Like hydraulics, pneumatics is a type of fluid power application where instead of an incompressibleliquid, pneumatics employ gas in their system.
- Hydraulics present certain advantages over pneumatics, but in a given application, pneumatic powered equipment is more suitable, particularly in industries where the factory units are plumbed for compressed air.
- The air used in pneumatic devices is dried and free from moisture so that it does not create anyproblem to the internal parts of the system.
- Moreover, to avoid corrosive actions, oil or lubricants are added so that friction effects can bereduced. Compressed air is used in most of the machines and in some cases compressed carbon dioxide
- As most of the pneumatic devices are air based, they have a less complicated design and can bemade of inexpensive material
- Mass production techniques can be adopted to produce pneumatic systems, which not only savemoney but save time too
- Initial cost is less; hydraulics equipment cost as much as twice the price of pneumatic equipment.
- For opening and closing valves, pneumatic systems work well because they can sustain overloadpressure conditions.
- Pneumatic actuators also have long life and perform well with negligible maintenance requirementthroughout their life cycle.
- Very suitable for power transmission when distance of transmission is more.
- In a nutshell, in order to execute low scale engineering and mechanical tasks, pneumatic deviceswould be the best suited and a viable alternative over hydraulic systems.

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Also, hydraulic systems are dirtier than pneumatic systems

3. proposed work:

To prepare any machine part, the type of material should be properly selected, considering design, safetyand following points:- The selection of material for engineering application is given by the following factors:-1) Availability of materials.

2) Suitability of the material for the required components.

3) Suitability of the material for the desired working conditions.

4) Cost of the materials.

In addition to the above factors the other properties to be considered while selecting the material areas follows:-1) Availability of materials.

2) Suitability of the material for the required components.

3) Suitability of the material for the desired working conditions.

4) Cost of the materials.

In addition to the above factors the other properties to be considered while selecting the material areas follows:- Physical properties:- These properties are colour, shape, density, thermal conductivity, electrical conductivity, meltingpoint etc. Mechanical properties:-The properties are associated with the ability of the material to resist the mechanical forces and load.

The various properties are:-

i) Strength : It is the property of material due to which it can resist the external forces without pneumatic jacking or yielding.

ii) ii) Stiffness : It is the ability of material to withstand the deformation under stress.

iii) Ductility:- It is the property of material due to which it can be drawn into wires undera tensile load.

iv) Malleability: It is the property of material which enables it to be rolled into sheets.

vi) Brittleness: It is the property of material due to which it pneumatic jacks into pieces with little deformation.

vii) Hardness: It is the property of material to resist wear, deformation and the ability to cut anothermaterial.

viii) Resilience: It is the ability of the material to store energy and resist the shock and impact loads.

ix) Creep: It is the slow and permanent deformation induced in a part subjected to a constant stressat high temperature.

We have selected the material considering the above factors and also as per theavailability of the material. The materials which cover most of the above properties are:-

1) MILD STEEL :

Why steel, in particular?

Simply because, in my humble opinion, it is the greatest material mankind has for construction. It ischeap, strong, readily available, easily cut, joined, and formed. Wood can be light and stiff, but not verystrong. The best aluminium is strong and light, but very difficult to join. Titanium is superb in termsof strength to weight ratio and stiffness but its incredibly expensive, difficult to obtain, and even moredifficult and expensive to machine properly. Theres no way youre ever going to perform a battery-weldfield-fix on a part made from 7075-T6 aluminium or titanium! In the end we come back to steel frommild carbon to some of the more exotic alloy steels pound for pound it is the most righteous materialavailable for our needs.

Where does steel come from? Steel is not a naturally occurring substance - it is entirely man made.

Steel is chiefly a combination of two naturally occurring elements: iron and carbon (along with smallamounts of other elements - depending on the steel in question). The process by which man makes steel,would, again, fill several volumes. Here is my amateur synopsis:

Iron is mined from the ground in the form if a reddish-brown rock called iron-ore. This ore is thensmashed up, strained, filtered, chemically treated etc, until ultimately it is melted in huge blast furnacesinto something called pig iron. The process uses coke (a type of coal), which in turn imparts largeamounts of carbon to the pig iron. As a result, pig iron itself is full of impurities, brittle, and unmachinable - practically useless. Except - it is the raw material from which all other irons and steels are made.

Pig iron is so produced in either huge vats of molten material, or it is cast into ingots (in fact, pig irongot its name because the ingots

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or “chunks” produced were thought to have resembled piglets).Pig iron is then refined into either metallic iron or steel using specialized furnaces and processes. Thedistinction between the two is that metallic iron has between 2-6A final word about carbon. carbon is critically important to our whole discussion because it is thepresence of carbon that turns the element of iron that is naturally soft and weak, into the strong, rigidmaterials we know as iron and steel. Precisely how this is so is beyond the scope of this article, sufficeto say:

The strength, hardness and toughness that make the ferrous based metals useful to us are profoundlyinfluenced by the remarkable sensitivity of the physical and chemical properties of iron crystals to relatively small percentages of carbon dissolved within their matrixes (actually, the sensitivity is to themovement of dislocations within the crystal space lattice). This sensitivity to dissolved carbon is in fact,the very basis of ferrous metallurgy.

The technology of pneumatics has gained tremendous importance in the field of workplace rationalization and automation from old-fashioned timber works and coal mines to modern machine shops and space robots. It is therefore important that technicians and engineers should have a good knowledge of pneumatic system, air operated valves and accessories.

The air is compressed in an air compressor and from the compressor plant the flow medium is transmitted to the pneumatic cylinder through a well laid pipe line system. To maintain optimum efficiency of pneumatic system, it is of vital importance that pressure drop between generation and consumption of compressed air is kept very low

3.1 diagram

Properties : Tensile strength 44.54 kgf/mm
Yield stress 28 kgf/mm
Hardness 170 BHN
Uses : General purpose steels for low stressed components

LOW-ALLOY STEELS FOR HEAT TREATMENT

FN02	case hardneable
FN08	heat treatable or case hardenable
8620	case hardenable
42CrMo4	heat treatable
100Cr6	heat treatable and wear-resistant

STAINLESS STEELS

316L	austenitic, non-magnetic, polish able
17-4PH	precipitation hardening, ferromagnetic

TOOL STEELS

M2	particularly hard and wear-resistant

MAGNETICALLY SOFT ALLOYS

F	Pure iron, very high saturation magnetization
FeSi3	Silicon iron, high saturation magnetization
FN50	Nickel iron, very high permeability

4.project design

DESIGN PARAMETERS:-STATEMENT FOR DESIGN:-The Pneumatic Shearing machine is to be designed to operate at the maximum pressure of 10 bar andthe lever operating force required is 150N, with the operating temperature of 2000 C. Cylinder SizingCalculator

The air cylinder sizing calculator below performs the following steps:

1. Calculate the area of the cylinder pistono Area = Pi x r2

2. Multiply the piston area by the air pressure to be usedo Area x Pressure = Force Output

Note: The force output on the rod end of a cylinder will be slightly less due to the displacement ofthe rod. The real force output of a cylinder will be less than the theoretical output because of internalfriction and external side loading. It is best to use a cylinder that will generate from 25

Material : Al. fs= 210kg/cm2

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Bolt material : M.S. ft = 280 kg/cm2
Design a cylinder of internal diameter for Di=8 cm, Internal air pressure
P= 25 kg/cm Max. ft=210kg/cm and max. ftb= 280 kg/cm.

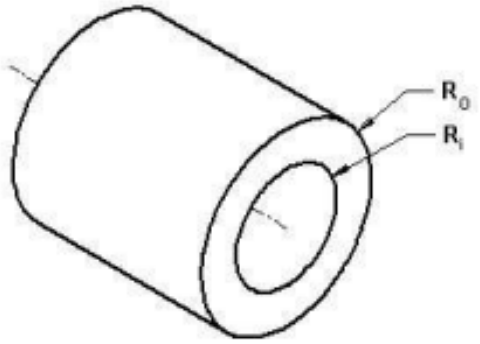

Figure 4.1
For safety purpose we will design the cylinder using factor of safety as 4
Therefore t = 4x 0.2 = 0.8 cm
To find the outer diameter of the cylinder,
Outer diameter Do = Di + 2 (t) = 100mm
Width of packing = 0.5 cm
In side diameter of cylinder, D = D + (2 x width of packing)
= 8 + (2 x 0.5)
= 8 + 1 = 9 cm
Force trying to separate the flanges,
F = 3.14 D1 x P/4
= (3.14/4) (9) (9) x 25
= 1589.6 kg
Force trying to be resisted by four bolts, i.e. Force on each bolt F = F1
Let dc = core diameter
F = / 4 dc ft 1/2 dc = (4 x 397.65/ 3.14 x 280)
= 1.344 cm
= 0.013 mm
Nominal diameter of the bolts are arranged at the corners of a square of such size that the corners ofthe nut clears the outside of the cylinder.
Therefore the minimum Length of diagonal of square,

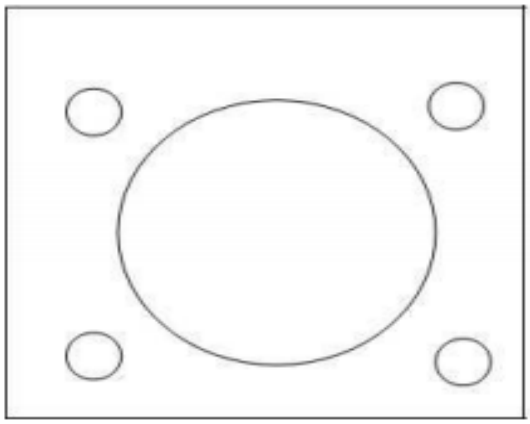

Figure 4.2:
L = D + 2 t + 2 d
= 8 + 2 x (0.8) + 2 x 2
= 13.6 cm
The sides of the square = L1 = L / 2 = 9.28 cm
The sides of the flange must be of sufficient length to accommodate the nuts and bolts Heads withoutoverhung
Therefore Length L2 = L1 + 2 d
= 9.28 + (4)
L2 = 13.28 cm
In order to find the thickness of the flange, consider the bending moment. It will take place due tothe force in two bolts. Bending moment due to the force in two bolts,
M1 = 2 F x L1/2
= 2 x 397.65 x 9.28 / 2
= 3690 kg - cm
The air pressure acting on half flange,
2 x F = 2 x 397.65 = 795.3 kg
The flanges are screwed with the cylinder having metric threads of 4.4 threads / cm (Pitch = (0.0228)Hence the Nominal or Major diameter of thread,
= D + 2 x t
= 8 + 2 (0.8) = 9.6 mm
Nominal radius of thread = Major diameter = 9.6 = 4.8 mm
Now the depth of the thread, = 0.64 x pitch
= .64 x .228 = 0.145 cm
= 1.4mm
Core or minor radius of the thread, = Nominal radius depth
= 5.6-0.145 = 5.45 cm.
Mean radius of arc over which load due to air pressure may be taken to be concentrated
= (Nominal radius + minor radius)
= (5.6 + 2.8) = 4.2 cm.
The centroid of this arc,

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= 0.6366 x Mean radius
= 0.6366 x 4.2 = 2.67 cm
Bending moment due to air pressure,
M2 = 2 x F X The centroid of t
= 22 x 122.65 x 2.67
= 655.86 kg- cm.
Since M1 and M2 are in the opposite direction
Therefore the resultant bending moment will be,
M = M2 M1 = 655.86 637.78 = 18.08 kg cm.
Material :- M.S.
The horizontal channel is subjected to bending stress Stress given by =¿ M/I = fb / y In the above
equation first we will find the moment of inertia about x axis and y axis and take the minimum moment
of inertia considering the channel of ISLC 75 x 40 size.
Design of welded joint:-Checking the strength of the welded joints for safety the transverse fillet weld welds the horizontal
channel and angles, plates. The maximum load, which the plate can carry for transverse fillet weld, is P= 0.707 x S x L x ft

5. Conclusion

Now we know that Pneumatic Shearing machine is very cheap as compared to hydraulic shearing machine.The range of the cutting thickness can be increased by arranging a high pressure compressor andthis machine is advantageous to small sheet metal cutting industries as they do not have rely on theexpensive hydraulic shearing machine.

6. Future scope

Since old age man is always trying to gain more and more luxurious. Man is always trying to develop more and more modified technique with increasing the aesthetic look and economic consideration.
Hence there is always more and more scope. But being the degree Engineers and having the ability tothink and plan. But due to some time constraints, and also due to lack of funds, we only have thoughtand put in the report the following future modifications:-1) It can be made to run has bottle cap sealing machine. The stationary platform can be made autoswiveling type by installing the timer and heat sensor arrangement on the platform. It can be done suchthat when the bottle mouth is sealed up to the desired temperature the electrical heater circuit gets cutoff . At the same time the motor installed on the reduction gear box starts operating the bevel gearingand the platform starts rotating thus it can be made auto rotating type.
2) It can be made hydraulic operated type by replacing the hand lever by hydraulic cylinder and alongwith the ratchet and Paul arrangement10. References

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