DESIGN AND MANUFACTURING OF WEARABLE PNEUMATIC CHAIR

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Abstract*: Today the world is now going to be compact. For suitability to the world, things are also going to be made of compact and smaller in size. Now the battle is also done between machines instead of man to man. To win this war and to thought regarding another parallel motive force to the automobile, we have thought of manufacturing "Chairless Chair" through the mission of the project. The exoskeleton based pneumatics support is basically a "chair" which is clothing like an exoskeleton, allowing users to walk or move at certain speed with the device while they work. This chair helps to rest the leg muscle when you are working for a long time. This new and innovative chair helps to comfort to thighs and back. It keeps back straight and reduces pain in the back as well as thighs. The overall weight of this exoskeleton pneumatic chair is only one kg so it doesn't burden on a wearer.*

Keywords*: Chair less chair, Mechanical device, Office hours, Reduce pain, Pneumatic support etc.*

I. INTRODUCTION

The world is getting compact day by day & we know the most useful devices are compact in size. If you are working in a restaurant kitchen, factory you will know you are tired for many hours. In manufacturing company keeping employee healthy has been major problem and challenges for companies around the world hence it needs to manufacture the "chair less chair" or "exoskeleton based pneumatics support". It is not possible to carry a stool around with you at every time that's why we are introducing this exoskeleton based pneumatic support. This exoskeleton based support helps to stand for long times. It improves walking and running economy and reduces the joint in pain or increases the strength in joint. It transfer load directly to ground. The exoskeleton is powerful mechanical devices. In pneumatic support, a pneumatic cylinder is used to engage and hold the person body it only wrap around thighs, so it reduces fatigue and increases the productivity.

II. FACTOR CONSIDERATION IN A PROJECT:

1) Compatibility with project and plan.
2) Availability of needed material and skill for research.
3) Move out away a critical technical problem.
4) Go back of financial expected.
5) Cost and availability of capital required for investment.
6) Estimate of costs of development, production, and marketing.
7) Growth prospects for the future.

III. OBJECTIVE:

The objective of our project is so simple with the help of chairless chair worker can move freely here and there without any stresses and fatigue or pain.

IV. THE SALIENT FEATURE OF A PROJECT:

1) Belt of chairless chair wrap around thighs without any difficulty.
2) Pneumatic cylinders are used for smooth suspension which makes comfort to a worker.
3) Light in weight.
4) Ease to wear.

V. RAW MATERIAL AND STANDARD MATERIAL:

Sr.no	Part Name	MAT	QTY
1	Cylinder 20 bore 250 stroke	STD	2
2	Pad	Mild Steal	2
3	Belt	Nylon	4
4	Shoe	Leather	2
5	Pivot Joint	Mild Steal	2
6	Shoe Holder	Mild Steal	2
7	Pop Rivet	Aluminium	24
8	Nut Bolt M10	Mild Steal	4
9	Round Pipe	Mild Steal	2

VI. CONSTRUCTION AND WORKING:

1) We will buy a leather safety shoe for which we will make a C- frame, the frame is fixed with shoes with the help of stud passed through heels of the shoe, both ends of the stud is tightened with the help of a nut. It will hold the shoe (shoe holder).
2) Now we will make a small round box one end of which is pivoted to shoe holder and another end is fixed to the bottom end of Piston connecting rod. Here we will use 10 bar pressure cylinder half filled with air and half with oil depends upon the weight of user.
3) The cylinder has 20 mm bore diameter, 250 mm stroke length and is provided with two flow control valves. Now, we make leg holder which will hold the thigh and is made by taking 2mm MS sheet bent to the shape of thighs.
4) Two nylon laces are fixed to the thigh holder with the help of pop rivet so that it can hold the leg. The leg holder is pivoted to round block and round block is fixed to a cylinder.
5) The cylinder pivoted with the help of this component to leg holder. We have used M-10 nut bolts for all pivots. Now, as the person can sit stand and walk comfortably.
6) The "Chairless Chair" consists of two identical "chairs," one strapped to each of the wearer's legs. It is important for the Chairless Chair to be adjusted to each user. Just like a piece of clothing, if the chair doesn't fit, it will not feel good. When adjusted correctly, you can comfortably relax with all your weight on the chair. "With the lower member of the chair strapped to the calf, a cylinder presses the upper member against the back of the thigh.

As the user squats, the released compression bar pushes the leg of the chair to a locked position, thereby supporting the body. When the user rises, the lower member is unlocked and is retracted by a cylinder to its original position, where it will not interfere with the user's movements.

VII. DESIGN CALCULATION:

Area x Pressure = Force Output

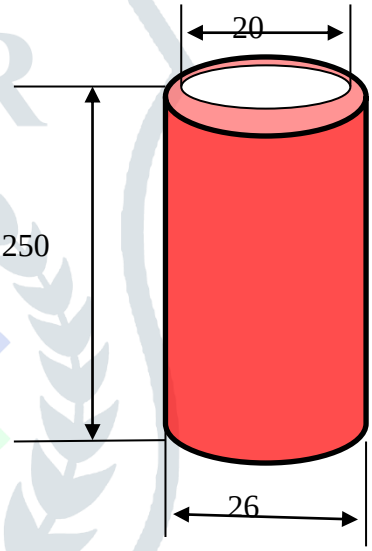
$F = P \times A$

Consider the weight of human sitting on chair = 100 kg. = 981 N

$981 = P \times \pi r^2$

$P = 981/ \pi 10^2$

$P = 3.12\ N/mm^2$



DESIGN OF CYLINDER:

Now for thickness of cylinder wall of cylinder,

Hooks law,

We have, $t = pd/2\ \sigma_{tensile}$

Where p = internal pressure= $3.12N/mm^2$,

d = diameter of cylinder=20 mm selected,

Material	Yield strength (Mpa)	Ultimate tensile strength (Mpa)
Aluminium alloy 6061-T6	241	300

We have ultimate stress for cylinder material

$\sigma_{ultimate} = 300\ N/mm^2$ aluminium alloy Considering factor of safety as 4.

We get permissible stress = ultimate stress/factor of safety

$\therefore \sigma_{tensile} = 300/4$

$\sigma_{tensile} = 75\ N/mm^2$

Inputting these value in the thickness formula,

We get, $t = 3.12 \times 20/2 \times 75$

$= 62.4/150 = 0.416$ mm.

t = 0.5 mm (say)

But standard available cylinder in the market is 3 mm thick, so our design is safe.

Outer Dia. of cylinder = 20 + (2 x 3) = 26 mm

The minimum outside diameter of cylinder is 26 mm.

DESIGN OF BOLT: (TENSION)

Bolt is to be fastened tightly also it will take load due to a rotation. Stress for C-45 steel ft =420 kg/cm^2. The standard nominal diameter of the bolt is 9.31 mm. From table in design data book, diameter corresponding to M10 bolt is 8 mm

Let us check the strength:

Also, initial tension in the bolt when the belt is fully tightened

P = 981 N is the value of force

P = 981 N

Also, $P = \Pi /4\ dc^2 x\ ft$

$$Ft = \frac{981 \times 4}{} = 3924/201$$

$$\frac{3.14 \text{ X } (8)^2}{}$$

Ft = 19.51N/mm2

The calculated ft is less than the maximum ft hence our design is safe. $\sigma_t = \sigma_b = 135$ N/mm^2 $\sigma_s = 67.5$ N/mm^2

VIII. ADVANTAGES:

1) It is automatic.
2) It is powerless
3) Provides maximum comfort
4) It will light in weight Compact in size and portable.

IX. DISADVANTAGES:

1) It is not adjustable to other people like our clothes and shoes
2) It is not adjustable to tall people.

X. CONCLUSION:

Hence our design is affordable and specially designed for the people at different assembly line workDue to this arrangement peoples felt relaxed who were suffering from the back pain and spinal cord diseases.

The design project is a success based on tilting device.

It reduced body fatigue and increased the workability of the person in the office hours as well as in the commercial places.

When in full-scale production, the EBHS will be available in three sizes,

From 5ft to 5"5": Regular Size

From 5"5" to 6ft: Large Size

From 6ft to 6"5": Extra Large Size

XI. FUTURE SCOPE:

The basic operation of this machine to reduce fatigue by sustaining the weight of the wearer in a similar fashion as that by a regular chair As your leg weakness progresses due to increasing in your age, your health care team may recommend equipment known as ambulation aids and bracing to help you with walking. Other devices can help give you needed support as the muscles in your neck and arms weaken. There may be a use of such exoskeletons which can give more effect than braces and ambulation aids. The specific aid or device that's best for you depends on the extent of the weakness and your willingness to use such a device. Using such instruments for walking climbing, doing work is safe and you're confident that you won't fall. For some, this means having an attendant or using an assistive device when walking short distances. Such instruments are going to bring more flexibility, mobility and most importantly the confidence Apart from in medical therapy and military sector, active or hoses or exoskeletons offer other applications, for example as a power booster during assembly work in production. They act here as a strength support device to prevent signs of fatigue that occur especially when performing repetitive actions.

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