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Research Paper

PNEU PORTABLE CHAIR

Engineering

KEYWORDS : Pneu Portable chair, Leg Exoskeleton, pneumatic, Pneumatic cylinders

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ABSTRACT

It's like a chair that isn't there, but magically appears whenever you need it. It's called the Pneu Portable chair and you wear it on your legs like an exoskeleton, when it's not activated, you can walk normally or even run. And then, at your wish, it locks into place and you can sit down on it. Like a chair that is now there. The idea came from wanting to sit anywhere and everywhere. The object of the same is to provide simple and effective means for supporting a person while at labor or during the pursuance of those classes of vocations requiring an upright or standing posture or for other purposes, the improved device being in connection with supporting devices on the person of the user and transportable with the latter from place to place without interference with the free movement of the person carrying the same. Standing for hours on end causes a lot of distress to lower limbs, but most workers get very few breaks and chairs are rarely provided, because they take up too much space so the best idea was to strap an unobtrusive chair directly to the body. The stiffening mechanism is actuated by a pneumatic cylinder which balances the weight of the worker in the way comfortable to the worker. Besides offering the user a seat, the exoskeleton is also able to improve the user's posture while they are standing. It keeps your back straight and can reduce the occurrence of bad postures for both healthy workers and those recovering from muscle related injuries. An aluminum and carbon fiber frame keeps the overall weight of the Pneu Portable Chair at just two kilograms, so it doesn't burden the wearer with too much excess weight and only marginally impairs movement. If we imagine using these in crowded train that like in India our commute will become very comfortable. To take it a step forward we can also help farmers picking fruit and even surgeons in the operating room so basically Pneu Portable chair as substantial application in everyday life.

introduction

IIn 21st century there are thousands of Industries all across the globe which are constantly striving on the betterment of their quality and increase their productivity to increase their profits. Day by day companies understanding that one of their most valuable assets are their employees and they are the one who work day and night to maintain the standards and the productivity of the company and make sure that their quality is maintained and so thus their name. So in this phenomena companies are also looking for ways to help the employees to provide a stress and fatigue free working environment again to ensure that their productivity does not decline. There are thousands of workers that work for just one company for 10-12 hours a day which may result in several physical ailments and may result in in prolong physical problems, so Pneu Portable Chair is a wearable device that can help people at work maintain optimal posture. This is a wearable chair that could be worn by production-line workers; the wearable chair idea is to relieve the stress of tasks that can cause such problems and pain. Unhealthy postures also lead to fatigue. Whether the difficulty is pain or fatigue or both, the worker's issue becomes a productivity issue, which is not beneficial to employers. So it is a wearable ergonomic leg device; or a leg exoskeleton; or a powered, lightweight and energy-efficient lower limb posture-support device. Device worn on the legs, which allows the user to walk or run when not activated. Once activated, the Pneu Portable chair uses a portable a pneumatic actuated cylinder to engage and hold the person's body weight, relieving the stress on leg muscles and joints. The user just need to move into the desired pose, it has a belt secures the wearable to the hips and its straps wrap around the thigh. Since it is the chair that can carry the person's body weight, the stress on leg muscles and joints is relieved. Pneu Portable Chair at just two kilograms, so it doesn't burden the wearer with too much excess weight. So all in all the Pneu Portable Chair does provide comfort to the workers working continuously for longer hours and reduces the fatigue thus increasing the productivity.

2. OBJECTIVE

Anyone who has worked at a job that requires long hours of standing in one place knows, remaining upright for an extended amount of time takes a heavy toll on your legs and back, yet the best solution that is available in the market is the uninspired standing mat until now. Physical strain, repetitive movements and poor posture can lead to conditions called Musculoskeletal disorders (MSDs), which are now one of the leading causes of various workday injury and illness. The current solutions present in the market have not been solving the problem faced by the workers so there is need for a radical and effective solution which is offered by Pneu Portable chair. Based on robotic principles of Bio-Inspired Legged Locomotion and Actuation, the exoskeletal assistive device consists of a pair of struts that run the length of the user's leg, across the thighs and at the heels of the user's shoes, where the weight of the person is subjected. Hinged at the knee to allow for normal movement—like. Walking and running its core innovation is the actuated by a pneumatic cylinder which balances the weight of the worker that can be engaged to direct body weight from the legs to the heels of one's feet.

3. PROBLEM DEFINITION

From the literature Survey it was Observed that no effective method is available for the weight if the person sitting on the pneumatic leg and also providing a free tolerating and flexible moment at cheap prices. So to tackle this problem we will be making a pneumatic leg preferably of Mild Steel for achieving high machinability and to maintain optimum weight of the external leg, allowing free and easy moment. And will increase the life of the product by using specialized and heavy duty materi-

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als. Now to tolerate the weight of the person wearing the leg we will incorporate pneumatically actuated cylinders which sustain the load of the wearer and will transmit the load thus providing suitable stress distribution. This would result in more stress permissibility and more load bearing strength

4. LITERATURE REVIEW

If our current job requires us to stand for long hours, this new "Pneu Portable chair" will ease the aches in our thighs and calves as per your work. 'Pneu Portable chair' helps users to rest their leg muscles by directing their body weight towards a variable. The "chair" is worn like an exoskeleton, allowing users to walk or run with the device while they work. To use, simply bend our knees to a comfortable stance to activate its damper that supports your body weight. It keeps your back straight and can reduce the occurrence of bad postures for both healthy workers and those recovering from muscle related injuries. It is a futuristic exoskeleton paramedical breakthrough, it so happens that the basic idea is to reduce the physical fatigue of people, who are constantly under one. Our product is inspired from the works of Zurich Based firm Nonee so it looks like the honor of Design Crossover Hit of the Week goes to Noonee's Chairless Chair. The conventional "Wearable Chair" consists of two identical "chairs," one strapped to each of the wearer's legs. Bonner states that "It is important for the 'Wearable 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.

5. METHODOLOGY

Factors in consideration of project:

1. Compatibility with the objective, plan.
2. Availability of needed scientific and *ensnaring* skills in R & D.
3. Critical technical problems likely to emerge.
4. Market prospects and potential of the proposed new product.
5. Availability of production skills needed.
6. Financial return expected.
7. Estimate of costs of development and production

6. AXIOMATIC DESIGN

The main intention here is to reduce the fatigue and to provide a sitting platform to the wearer. So to fulfill this task the weight of the wearer should be efficient sustained without any deformation in the body of Legs. It should also be easy to wear and carry around, so this objective adds another challenge to look forward that the weight of the leg should not be very high which should not contradict with the main objective of the device .

So to make it string enough to sustain the weight of the wearer, the body should have enough stiffness to carry the payload and also providing a smooth movement to the cylinder piston. Consequently the size of the leg structure should be accurately sensed. Therefore it is not an easy task to accurately adjust the size of the leg whilst making it strong enough to sustain the payload. Now the most crucial component here is the Pneumatic Cylinder which will be exposed to around 90% of the payload.

6.1 GENERAL PROCEDURE

Selection of groups of mechanism for the desire motion.

1. Calculation of the force and energy on each member.
2. Selection of material.
3. Determining the size of component drawing
4. Manufacture.
5. Preparation of component drawing and sending for manufacture.
6. Manufacturing and assembling the machine.
7. Testing of the machine and for functioning.

6.2 SELECTION OF MECHANISM

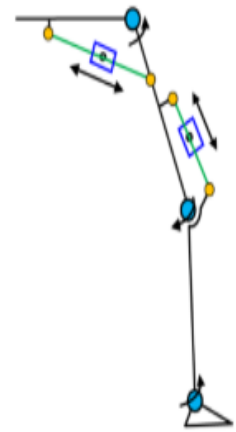

Figure 1: BASIC DESIGN

D.O.F =

N: - No. of Links

J: - No. Of lower Pairs

H: - No. of higher pairs

No. of links = 4

No. of Lower pair = 5

No. of Higher pair = 0

D.O.F = 3(4-1)-2(5)-0

= -1

SO THE STRUCTURE IS SAFE

FORCES ON TH MEMBERS

A.THERMAL STRESSES

$\sigma t = \alpha E(\Delta T)$

E = Modulus of elasticity = 210 Gpa

α= Coefficient of thermal expansion = 12× per °C

ΔT= Temperature difference = 5°C

σt = 12.6MPa

HENCE THE THERMAL STRESSES ARE UNDER LIMIT

B.PRESSURE IN THE CYLINDER

From meticulous market Research and calculation it was decided to use a cylinder of thickness 0.5 mm and 250 mm stroke length. Correspondingly the diameter of the cylinder in obtained 26 mm Force due to internal pressure p acting on area = p. π. D/4

To maintain the equilibrium and suitable working conditions the internal pressure of the cylinder must be equal to the weight of the wearer.

So assuming a man weighing 100Kg sits puts on the legs then a force of 1000N will act on both the legs. So each leg would be have to sustain 500N of force.

500 = p. π. D/4

On Calculation a Pressure of .094174 MPa will be needed to maintain Equilibrium and Easy working.

C.STRESSES IN CYLINDER

Hoop's stress = $\frac{pd}{2t}$

Longitudinal stress = $\frac{pd}{4t}$

Hoop's stress = .2446MPa

Longitudinal stress = .1223MPa

7. DESIGNAL CONCLUSION

All the Stresses Generated in the body are well within the limits and hence are safe.

RESULT

A conceptual design is presented for low cost leg exoskeleton for employees to seat while working.by referring to human seating and walking characteristic a leg mechanism has been conceived with as kinematic structure whose mechanical design can be used by employees as an wearable exoskeleton. As per the Specified Design parameters the body can suitably carry around the 100Kg of Human Body weight. In the later part to reduce the cost Oil was also brought in the weight sustaining mechanism thus providing better results.

CONCLUSION

These type of Machine with ergonomical background can be easily upgraded with the use of more advanced technologies and culminating various facilities into one body and be constantly modified .A basic idea of how a exoskeleton using Pneumatic or Hydraulic Cylinder can be used to reduce the fatigue by using simple kinematic mechanisms. In this Particular Machine due to certain restrictions not much advancement has been made and it is similar to a tailor made clothing which is just suitable for one single person and may not fit properly to other user. Although as mentioned with advanced techniques it can be made more generalized for more no, of people to use it. It has several major applications in real time scenario where it can be worn in the crowded trains or public places with space constrains .Also it can be worn by Traffic Police who work for long hours and are exposed to fatigue for a prolong period of time .

FUTURE SCOPE

The basic operation of this machine to reduce fatigue by sustaining the weight of the wearer in similar fashion as that by a regular chair. As your leg weakness progresses due to increase 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 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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