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DESIGN OF WEARABLE CHAIR

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Abstract - *A The exoskeleton based pnueumatic bolster is essentially a "chair" which is worn like an exoskeleton, enabling clients to walk or keep running with the gadget while they work, this chair encourages clients to rest their leg muscles by coordinating their body weight towards a variable damper joined to the casing and guides the weight to the ground. It comprises of two indistinguishable "chairs", one lashed to every one of the wearer's legs. To utilize, essentially twist your knees to an agreeable position to enact its damper that backings your body weight. This exoskeleton based help would be valuable to individuals whose present place of employment expects them to remain for extend periods of time. This new and modernized "chair" will facilitate the hurts in the thighs and back. It is particularly of extraordinary use to the elderly , specialists in mechanical production system , trekkers and military who don"t dependably have the choice of pulling a chair to lay themselves in a hurry ! It holds your back straight and can diminish the event of terrible stances for both solid laborers and those recouping from muscle related wounds.*

Key words: exoskeleton, working efficiency, cost effective, Pneumatics.

I. INTRODUCTION

Presently a day in quickly developing mechanical time there are such a significant number of innovation imagined to expanded in efficiency yet vital given to human solace this at second need and expanded in profitability is at first in the event that we need to stand ceaselessly for drawn out stretch of time with no unwinding and at the same time we need to concentrate on our work it will influence on our wellbeing and prompt certain issue, for example, hypertension, sadness and so on.

To beat the above disservices and accomplish both profitability and human wellbeing and solace the level seat isn't adequate this will prompt making of exoskeleton chair this is chair which can wear by client as demonstrated by its name with help of straps it offered help to leg and thigh of client which result into diminishment in muscle torment and issue in regards to bones emerge because of keeps remaining for extended periods. In the event that you work some place, for example, an industrial facility, distribution center, or eatery kitchen, at that point you'll know how tiring it can be to remain for a few hours on end. Lamentably, in any case, it isn't generally viable or safe to bear a stool with you wherever you go. That is the reason Swiss start up noonee has made the Chair less Chair. Worn as an exoskeleton on the back of the legs, it gives you a chance to walk or even keep running as required, yet can be bolted into a supporting structure when you go into a sitting position. Organization CEO Keith Gunura began building up the Chair less Chair in 2009, when he was an understudy in the Bioinspired Robotics Lab at the ETH Zurich explore organize. He was enlivened to do as such by recollections of his first occupation, in which he worked while remaining at a bundling line.

Presently in model shape and being effectively advertised, the gadget uses a controlled variable damper to help the wearer's body weight. The client basically twists their knees to get themselves down to the level at which they'd get a kick out of the chance to sit, and after that draws in the damper. The Chair less Chair at that point locks into that The Chair less Chair at that point locks into that arrangement, coordinating their weight down to the foot rear areas of their shoes, to which it is joined – it additionally appends to the thighs through ties, and to the midsection utilizing a belt.

II. DESIGN METHODOLOGY

Methodology includes the method to achieve the final objectives of project. Following are some method or sequence of activities used in project to achieve final objectives.

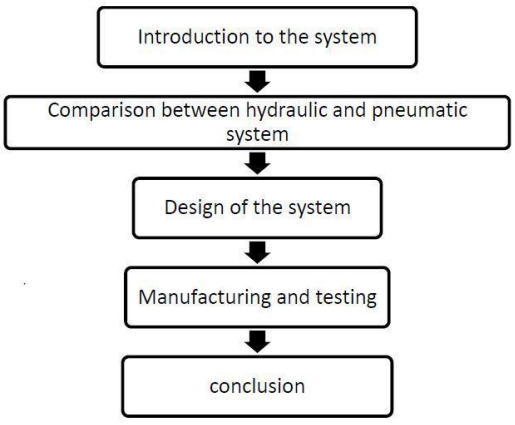

Fig. Flow chart of methodology

A. Material Selection

We have to select following material for respective components as follows. Pad – M S ,Belt – nylon, Shoe – leather , Shoe holder ,M S Square block ,M S Studs – M S

Cylinder – std. cylinder.

B. Procurement of material

We have to purchase from various suppliers and some material from scrap

C. Designing of proposed model

We have to draw a cad model or sketches of various components.

D. Assembly

After drawing of cad model of require system we have to assemble component as per proposed diagram

E. Testing and analysis

After assembly we have to go for testing and , for required different loading condition.

F. Validation

Than we have to test the model by seating number of person having different weight in order to check the sustainability of actual model

III. PROPOSED SYSTEM

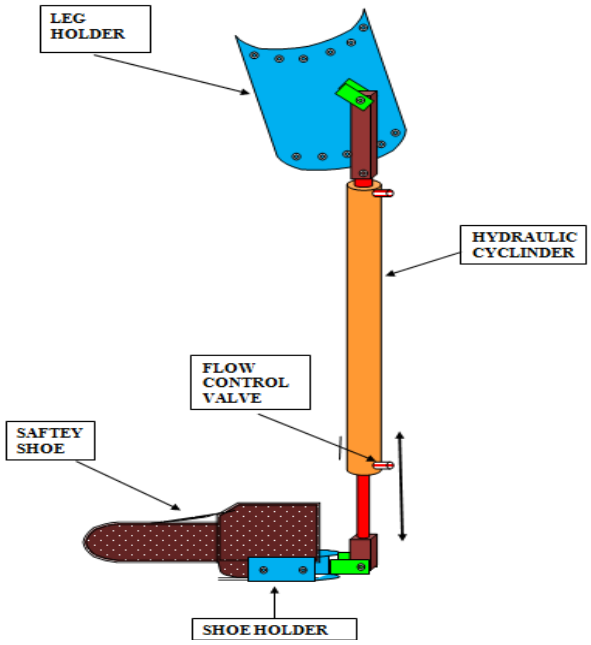

Fig. proposed system

IV.PROBLEM DEFINITION

At the point when the laborer or any individual needs to remain for long day and age constantly (over 8 hours) his/her working proficiency diminished and its profitability abatements to lessened weakness and expanded human efficiency we are going to grew such exoskeleton seat which enable used to take a site anyplace without interfering with its working condition.

V. PROJECT OBJECTIVE

The primary goal of the venture is to lessen weariness because of consistent standing stance amid working hours and increment working proficiency of client, and henceforth venture has some more destinations. To give legitimate working condition without interfering with work process. Decrease weight of seat.

Decrease cost and multifaceted nature of system& make framework as straightforward as conceivable to utilize.

The innovation of pneumatics has increased colossal significance in the field of work environment justification and robotization from out-dated timber works and coal mines to present day machine shops and space robots. Certain qualities of packed air have made this medium very appropriate for utilized as a part of current assembling and generation enterprises. It is in this way vital that specialists and architects ought to have decent information of pneumatic framework, air worked valves and embellishments. A pneumatic framework comprises of a compressor, pipe lines, control valves, drive individuals and related helper apparatuses. The air is compacted in an air compressor and from the compressor plant the stream medium is transmitted to the pneumatic barrel through a well laid pipe line framework. To keep up ideal effectiveness of pneumatic framework, it is of key significance that weight drop amongst age and utilization of compacted air is kept low.

VI. DESIGN AND CALCULATIONS

6.1 Material selection

1	Cylinder-20mm bore, 250 mm stroke	Std
2	Pad	Ms
3	Belt	Ny
4	Shoes	Le
5	Shoe holder	Ms
6	Pop rivet	Al
7	Nut bolt M8	MS
8	Square pipe	MS
9	MS flat bars	MS
10	Stud	MS

6.2Design of cylinder

Area x Pressure = Force Output

F = P X A

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

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

$P = 981/ \pi 10^2$

$P = 3.12 N/mm^2$

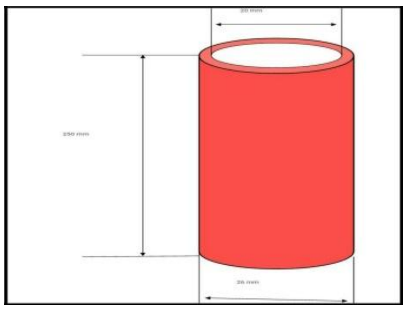

Fig. cylinder dimension

Now for thickness of cylinder wall of cylinder,

Hooke's law

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

p = internal pressure= 3.12N/mm², &

d = diameter of cylinder=20 mm selected,

ft1 = permissible stress

We have ultimate stress for cylinder material

$\sigma_{ultimate}$ = 300 N/mm² aluminum considering factor of safety as 4, $\sigma_{tensile}$ =300/4

In putting these value in the thickness formula,

We get, t = 3.12 x 20/2 x 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 Load of person on piston rod, so it may fail under bending

4140 Alloy Steel (UNS G41400)

Properties	Metric	Imperial
Tensile strength	655 MPa	95000 psi
Yield strength	415 MPa	60200 psi
Bulk modulus (typical for steel)	140 GPa	20300 ksi
Shear modulus (typical for steel)	80 GPa	11600 ksi
Elastic modulus	190-210 GPa	27557-30458 ksi
Poisson's ratio	0.27-0.30	0.27-0.30

Fig. (Mechanical Properties alloy steel)

M = WL/4 = 981 × 250/4

= 6131

Z= π/32 x 12.5 ³

Z= 191.8mm³

σ_b (induced)= M/Z = 61312.5/191.8 = 319.6 N/mm²

(Fig No. 3.2 Piston Rod)

As induced bending stress is less than allowable bending stress i.e. 655 N/mm² design is safe.

6.3Design of bolt: tension

Bolt is to be fastened tightly also it will take load due to rotation. Stress for C-45 steel ft =420 kg/cm². STD nominal diameter of bolt is 9.31 mm. From table in design data book, diameter corresponding to M8 bolt is 8 mm.

Let us check the strength:-

Also, initial tension in the bolt when belt is fully tightened P=981N is the value of force also

P = Π /4 dc²x ft

Ft = (981x4)/(3.14x8^2) = 3924/201 =19.51N/mm^2 calculated ft is less than the maximum ft hence our design is safe. $\sigma_t = \sigma_b$= 135 N/mm² σ_s = 67.5 N/mm².

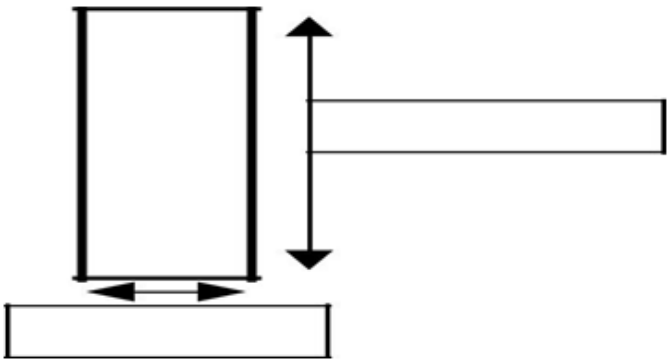

Fig. C clamp plate

t = thickness of arm in mm. Fb=180N/mm² Bending moment at 25 mm from center of shaft,

W = maximum force applied by human = 981 N

M = W * LM = 981* 25 = 24525 N-mm And section modulus=Z=1/6 bh²
Z=1/6*4x18²
Z=1/6*1296
Z=216mm³. Now

using the relation, Fb=M/Z
Fb= 24525/ 216 = 113.45 N/mm^2

Induced stress is less than allowable so design is safe

6.4Design of transverse fillet welded joint:

Checking the strength of the welded joints for safety

The transverse fillet weld welds the side plate and the edge stiffness plates The maximum load which the plate can carry for transverse fillet weld is

P = 0.707 * S *L * ft Where,
S = size of weld, L = contact length = 25mm The tensile force along with the friction is 981 N Hence,
981 = 0.707 * 3.4 * 10 * ft induced Hence let us find the safe value of _ft'

Ft= (981)/ (0.707*3.4*25)

Ft induced =16.32n/mm^2

Since the calculated value of the tensile load is very smaller than the permissible value as ft=21 N/mm^2. Hence welded joint is safe.

VII. CONCLUSION

Henceforth our plan is reasonable and uncommonly intended for the general population at various sequential construction system work Due to this course of action people groups felt loose who were experiencing the back agony and spinal string ailments. The plan venture is a win in view of tilting gadget. It decreased body weariness and expanded the workability of the individual in the available time and in addition in the business places. At the point when in full-scale generation, the EBHS will be accessible 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

VIII. Future scope

The fundamental activity of this machine to decrease exhaustion by supporting the heaviness of the wearer in a comparative form as that by a general seat as your leg shortcoming advances because of expanding in your age, your medicinal services group may prescribe gear known as ambulation helps and propping to help you with strolling. Different gadgets can help give you required help as the muscles in your neck and arms debilitate. There might be an utilization of such exoskeletons which can give more impact than supports and ambulation helps. The particular guide or gadget that is best for you relies upon the degree of the shortcoming and your eagerness to utilize such a gadget. Utilizing such instruments for strolling climbing, doing work is protected and you're sure that you won't fall. For a few, this implies having a chaperon or utilizing an assistive importantly the confidence Apart from in medical therapy also, military division, dynamic or hoses or exoskeletons offer different applications, for instance as a power sponsor amid get together work underway. They act here as a quality help gadget to avoid indications of weariness that happen particularly when performing redundant activities.

IX. Assembly of pneumatic support

Fig .Assembly of pneumatic support

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