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"Design & Development of multipurpose, space saving seating arrangements using Ergonomics"

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Abstract
In India majority of Indian middle class populations are living in small flats and homes this is mostly because of their economy scale as well as the lack of space availability for living. Moreover, high population density leads many other problems such as high gap between rich and poor, not proper comfort due to Ergonomics. These are common problem in now days. Space saving seating arrangements is one of the options to solve these problems.
In this paper, we will introduce the innovation designs for space saving seating arrangements developments with waste material (vehicles used tubes & tyres); today one can find a wide array of chairs reflecting the current understanding of ergonomic experts and designers as how to best support traditional tasks. But seating work is changing. Traditional jobs involving only one primary, forwards oriented task are giving way to new approaches to work and a wide variety of task postures and positions.
This paper will help people to understand the importance of Ergonomics with anthropometric principles of multipurpose space saving seating arrangements in different places.
Keywords: Space Saving, Seating Arrangements, Furniture's.

I. Introduction

Seating arrangements, Chairs & Furniture's were earliest inventions of man. A space saving seating arrangements is mobility or space saved device designed especially for Middle class persons as well as living in small flats and homes this is mostly because of their economy scale and lack of space availability for living.

The word 'anthropometry' means measurement of the human body. It is derived from the Greek words 'anthropos' (man) and 'metron' (measure). Anthropometric data are used in ergonomics to specify the physical dimensions of workspaces, equipment, furniture and clothing to ensure that physical mismatches between the dimensions of equipment and products and the corresponding user dimensions are avoided.

Furniture is built to make people live easier and more comfortable. The furniture industry divides them into various board groups. One way of grouping furniture is according to where and how it used. Furniture that is used at home makes up another large group and can be classified by its style.

II. Design Methodology

Design Methodology helps to find out the best solution for each design situations. A systematic approach and procedure is to be followed to achieve the suitable solution. It involves the following steps:

- Journals and patent research
- Market Study and User Survey
- Design a different concept
- Development with waste material
- Ergonomic details with Anthropometric principles
- Conclusion

III. Literature Review

Journal papers and patents explored here are related directly or indirectly to the proposed area of work that is design and development of **space saving seating arrangements.** These papers are to support and enlighten the whole process of design in the specific area.

1. Various multipurpose furniture's

This paper, introduce the innovation designs, the hard wares, the application and future development, cost & price and the important market of transformable space saving furniture. This paper will help people to

understand the importance and the potential value of transformable multipurpose space saving seating arrangements in different places.

2. Multipurpose,space saving seating arrangements

Study objectives of this paper is that can be provide some different modeling parts of seating arrangements by using CAD approach and one part of seating arrangements can Finite Element Analysis using ANSYS tools with different load applicable in comparison of different material selections.

3. Multipurpose Modular, Flexible and Space Saving Dining Table

Existing dining furniture was analyzed in detail including its components and parts and their assembly and sub-assemblies. After the data collection the user needs were analyzed and QFD was generated. Priorities in the QFD were modular, flexible, shape and size. PDS was arrived at based on the QFD. Five concepts were developed and based on PDS and one concept was finalized for further detailing. Final concept was selected using weighted ranking method by evaluating all the concepts. Drawings were developed for final concept, a prototype was made and ergonomic validation was done. In stowed form, the proposed concept is found to occupy just less than 25% of its deployed area. We thereby believe that the proposed design will largely suit the constrained space conditions of the urban segment in India.

4. Foldable Seating Device Useful in Public Places

This paper relates to a foldable, a portable stool, and more particularly, to a portable stool that can be carried in a compact manner and utilized in situations of inadequate seating. Study Objective of this paper is that we can provide some means to the elderly people or those with chronic conditions. Who do not get seat in the train/buses/public places should be beneficial. Also one can use it anywhere at their own will. This paper relates to foldable/ portable stools and has its general objective to produce a device of such a kind which is of compact nature when folded or in inoperative position and is of strong and sturdy character when open or operative.

5. Conceptual Wheelchair cum Stretcher

New features like document holder, provision for oxygen cylinder, and rotatable handle have been introduced. Final concept was selected using Pugh selection method by evaluating all the concepts with bench marked product. A 1:2 mock up model had been made to validate the concept and feedback was collected from users. Our study shows that it is possible to save 50% space by the wheelchair- cum- stretcher design. The product will thus likely be an efficient mobility aid in hospitals.

6. Transformable space saving Furniture

In most metropolises in the world, people's average living area is getting smaller and smaller. Moreover, high population density leads many other problems such as high gap between rich and poor, high energy cost and house price. These are common problems in metropolis nowadays. Transformable space saving furniture is one of the options to solve these problems. This report will help people to understand the importance and the potential value of transformable space saving furniture in metropolises.

7. New concept of furniture design by using space saving approach

The method to use for select the best concept design among the five concept design is "weighted rating method". The highest weight rating of design concept will continue the future development in this project. All the part of sofa bed is draw by using Solid Works. After that, some of the sofa bed part to be used for FEM analysis obtains some useful information. Besides that, the manual calculation will compare with the FEM analysis result. Finally, all the sofa bed part will convert into detail drawing and attach it in this report.

8. The Future of Ergonomic Office Seating

Today, one can find a wide array of chairs reflecting the current understanding of ergonomic experts and designers as how to best support traditional office tasks. But office work is changing. Traditional jobs involving only one primary, forward oriented task are giving way to new approaches to work and a wide variety of task postures and positions. This white paper addresses five related issues:

1. The importance of ergonomic seating
2. How do we sit?
3. What research tells us about sitting
4. What a chair should do
5. The future of ergonomic office seating

IV. Research and Analysis

Market Study & User Survey

User study needs to be conducted in order to experience the user and its environment. This may help the designer to design an appropriate product which suits the environment. User study has been conducted around 8-10 seating arrangements or chairs in order to find the user experience and various issues regarding chairs space occupied as well as some problems identified regarding ergonomically view. Initially all the stake holders are considered and study has conducted in order to get more information.

Observations from Market Study & User Survey are,

- Majority of Indian middle class populations are living in small flats & homes.
- To understand the lifestyle, need and comfort
- Requirement of foldable as well as movable space saving seating arrangements
- Multipurpose, Modular, Flexible And Space -Saving
- Ergonomically perfect product
- Low Cost of product so used some waste material or recycle material.
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V. Design a different concept

Concept 1 [Capsule Shape Seating Arrangements]

The main criteria considered for this concept is space saving model. A Capsule shape seating arrangements as a form of decorative art. It has beneficial to us in two ways not only for a decoration but also for a seating arrangements by separating chairs & tables.

Fig.01 Assembly of Capsule Shape Seating Arrangements

Fig. 02 Disassembly of Capsule Shape Seating Arrangements

Concept 2 [Rounded Movable Seating Arrangements]

This concept is perfect for study table as well as dining table. It is used some sliding mechanism & small rolling balls for moving one place to another place. It's useful for the kids in Garden or play school also. Rounded movable seating arrangements is also space saving model due to sliding seating arrangements or chairs.

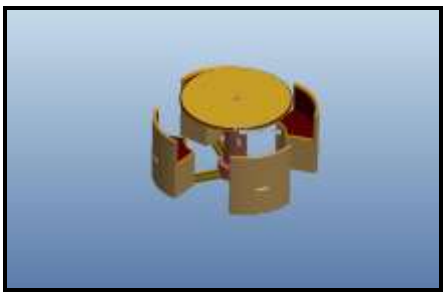

Fig.03 Assembly of Rounded Movable Seating Arrangements

Fig.04 Assembly of Rounded Movable Seating Arrangements in different View

Concept 3 [Foldable Armchair Seating Arrangements]

This concept is space saving & proper folding seating arrangements. Its multipurpose light weight, compact, folding seating arrangements and one stand of armchair are adjustable as per the requirements.

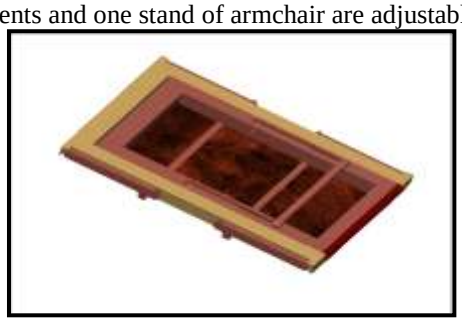

Fig.05 Assembly of Foldable Armchair Seating Arrangements

Fig.06 Assembly of Unfold able Armchair Seating Arrangements

Development with waste material [Vehicles Used Tubes & Tyres]

This is another new concept of seating arrangements from waste tubes & tyres of vehicles:

In the concept of seating arrangements from tyres. We have taken two tyres and they have fixed by using nut & bolt one above the other. To the upper tyre nylon rope has woven in such a way that a tight base must form.

Innovative design of seating arrangements from tubes. Two tubes are taken. They are placed one above the other and are tightened by 8 bags belts. First of all lower tube is wrapped by belts and they are pulled above the upper tube and sewed itself. Nylon rope is tightened in rounded manner.

On comparing above two types of seating arrangements, the seating arrangements of tubes is space saving because we can fill air in it whenever necessary and when there is no use of it we can remove air from it and can be folded easily and in this way we can save space.

Fig.07 Seating Arrangements from Tubes & Tyres

Ergonomic details with Anthropometric principles

All dimensions are considered according to Indian anthropometric data.

Human dimensions are considered for both male and female and 95th percentile of hip breadth, elbow to elbow and buttock to popliteal is taken for the sitting posture.

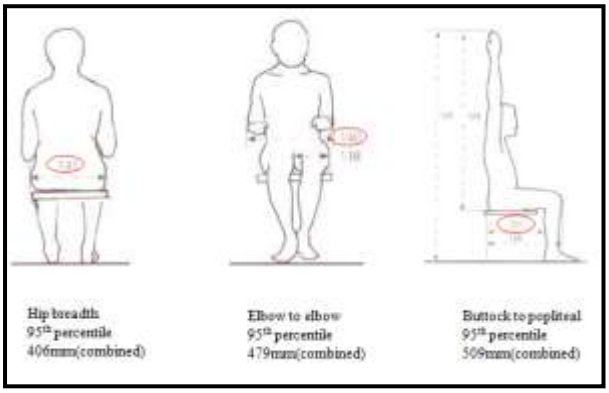

Fig.08 Anthropometric data

Elbow rest and popliteal dimensions are taken as 50th percentile and combined dimension of 210mm and 419mm respectively for the design. Stature dimension is taken as 95th percentile and the dimensions as 1771mm.

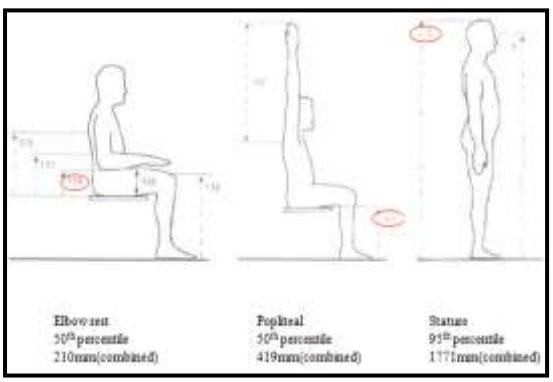

Fig.09 Anthropometric data

The Importance of Ergonomic Seating

Sitting versus seating–What's the difference?

Sitting is an activity– It's something people do. Sitting is active, involving motion, balance, position, posture, and control. Sitting is an innate behavior involving both body and mind. Sitting is natural. People sit in a wide variety of ways and places. People don't need to learn how to sit. Sitting is simple.

Seating is a category of devices– People use seats to support themselves when they sit. Seating includes anything people sit on or in. The most common form of seating is a chair.

But seating can also include benches, stools, swings, pillows, balls, baskets and such (Lueder & Noro, 1994). Using a seat – any modern, complex, highly adjustable, task chair – is not natural. Complex seating often requires training. Users may need to learn to use them. Seating can be complicated.

VI. Conclusion

Space saving seating arrangements is an innovative product that has much opportunity for future development and a huge potential market in metro cities for small flats and homes. The designs of transformable or foldable space saving seating arrangements can be even more variables with ergonomic & development with waste material [vehicles used tubes & tyres] on which we focused for this paper. Such type of space saving seating arrangements can help to designers, architects & engineers to make more effective and efficient.

In order to improve the future of space saving products, designers need to create more innovative ideas to understand the importance of ergonomics and used with waste material of our daily life. These kind of innovative designs could also save ergonomically problems of people and lower the cost of product due to use of waste material.

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Biographies

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