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MANUFACTURING OF EASILY FOLDABLE AND MOBILE CHAIR

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Abstract: The foldable chair has become somewhat of an icon, and its design has not been changed much throughout the many decades it has been around. Nowadays there are plenty of different kinds and versions of foldable chairs. Their frame is mostly made out of aluminum or wood so that their weight can remain low and therefore convenient to carry. The foldable chair, one version of foldable beach chairs and closely related to the one Petrie patented, was a popular chair for being used at ships. Its inventor remains uncertain though. The seat and backrest are often made out of a water-resistant fabric.

In this paper we study the various research papers on manufacturing of easily foldable and mobile chair for person, the used the different technology for foldable and mobile chair.

Keywords: chair, linkages, foldable furniture

1. INTRODUCTION

One could imagine that there are as many different types of foldable chairs as many as types of people. It is an object that needs to most everyone. In its different embodiments it can be humble or regal, made of traditional wood or high-tech polymers, simple in concept or highly charged with meaning. Fundamentally, the requirements for a chair are few. It is essentially a horizontal surface at a logical distance from the ground meant to support the human body while sitting. A vertical surface is provided for back support. It can have arms or be armless. While these are the basic elements, a chair is more than the sum of its component parts. The psychological relationship with the user, perhaps stronger than with any other type of furniture, can connote symbolism about status and beliefs. Chair design considers intended usage, ergonomics (how comfortable it is for the occupant), as well as non-ergonomic functional requirements such as size, stack ability, fold-ability, weight, durability, stain resistance and artistic design. Intended usage determines the desired seating position. Easy chairs for watching television or movies are somewhere in between depending on the height of the screen. Ergonomic design distributes the weight of the occupant to various parts of the body. A seat that is higher results in dangling feet and increased pressure on the underside of the knees. It may also result in no weight on the feet which means more weight elsewhere. A lower seat may shift too much weight to the "seat bones". Hence there is a great need to develop ergonomically good chair to reduce the pressure on human body. This requires a detailed study of Anthropometry i.e., the human body on measurements like height, breadth and length of various human body parts for his/her maximum comfort. A locker is a small, usually narrow storage compartment. They are commonly found in dedicated cabinets, very often in large numbers, in various public places such as locker rooms, workplaces, middle and high schools, transport hub and the like. They vary in size, purpose, construction, and security. Lockers are usually physically joined together side by side in banks, and are commonly made from steel, although wood, laminate, and plastic are other materials sometimes found. , in various public places workplaces, middle and high schools, transport hub and houses the lockers are placed separately and at some distance. And these lockers cannot be frequently accessed. Now-a-days, individual components are integrated, because products are expected to have maximum features embedded in a single package, so as to make it smart and economical. This work entitled with "Design and fabrication of multi-utility chair" is intended to do such an improvement in the design by integrating chair for an individual with desk and a locker.

2. LITERATURE REVIEW

This chapter presents the background information on the issues to be considered in the present research work and to focus the significance of the current study.

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Shiv Prakash, and et. al., (2022), this work is proposed to design and fabricate a “Chair cum ladder”. It involves an idea of integration the chair with ladder by considering some vital factors, such as enhancing the human comfort at economical price, minimizing the floor space requirement for individual furniture. Process involves usual design steps, starting from sketching the different possible concepts, optimizing and modeling the product into real-time prototype, using methods such as cutting, drilling so on.

Gokul K, and et. al., (2023), in today's day-to-day life, it is very difficult to have time to stay relaxed while doing work. According to the research, 48% of slip disc problems can occur in workers due to only standing work. There is a need to have arrangements such that when workers get free time and while working, you can sit and relax. Therefore, the idea of a standing chair comes into the picture. It gives you the ability to sit anywhere and everywhere. One can easily stand and relax as if sitting, and can easily sit when I get some free time. This new concept is very useful for industrial workers. In this project, we will design and develop the ergonomic chair that can be introduced in every industry where workers can work efficiently, improve production, and lead healthy life without any problems like varicose veins etc.

Zhiguo LU and et. al., (2015), presented the Under the Solid works design environment; the modeling of folding chair based on the omni-directional mobile rescue platform has been finished. This integral structure design can achieve two functions of transshipment goods and manned patrol, and the electromagnetic clutch is used to control the chair reversing. The optimum designing has been realized by analyzing the static mechanical properties of some important components under the ANSYS environment. This folding chair is compact and flexible and is suitable for various emergency rescues

Avinash B. and et. al., (2014), proposed to design and fabricate a “Multi-utility Chair” to ease the use of the product. It involves an idea of integrating the chair with desk and locker by considering some vital factors, such as ergonomics and anthropometrics for enhancing the human comfort at economical price, minimizing the floor space requirement for individual furniture. The design is made along with the fabrication of a prototype that is demonstrated at the end of this paper. Process involves usual design steps, starting from sketching the different possible concepts, optimizing and modeling the product using „solid edge ST4‟ package, followed with fabricating the virtual model into a real-time prototype, using methods such as cutting, welding, drilling so on

Fadhila Lady Sifredy and Nur Isnaeni, (2021), presented the elderly in carrying out activities both indoors and outdoors will experience difficulties due to their declining physical condition. Therefore, they will need extra time and effort and tend to tire easily and feel sore when doing various activities (such as sitting, walking, or standing for too long). It is necessary to produce a product that can help and make the elderly more comfortable in carrying out activities. Designing and developing a folding seat for the feasibility and comfort and safety of the seat mat. Tried the use of a folding seat mat. This research is a Research and Development (R&D) research. The sampling technique is purposive sampling with a total of 5 elderly people. The research instrument used a questionnaire. Data analysis using frequency distribution test research results characteristics of respondents have an average age of 66.4 years with the youngest age 61 years and the oldest age is 70 years. The comfort level of using the Elderly Sitting Mat has an average comfort level of 33.8. The model or display of the seat used has a length of 150 cm and a width of 50 cm. This seat mat is equipped with safety on the right and left with a length of 35 cm, and there are recesses to adjust the angle of the backrest so that it can be adjusted as needed. This folding seat mat can be folded for easy storage. The level of comfort for the elderly when using the Folding Seat is in the very good category. The comfort level of using the Elderly Sitting Mat has an average comfort level of 33.8. The model or display of the seat used has a length of 150 cm and a width of 50 cm. This seat mat is equipped with safety on the right and left with a length of 35 cm, and there are recesses to adjust the angle of the backrest so that it can be adjusted as needed. This folding seat mat can be folded for easy storage. The level of comfort for the elderly when using the Folding Seat is in the very good category. The comfort level of using the Elderly Sitting Mat has an average comfort level of 33.8. The model or display of the seat used has a length of 150 cm and a width of 50 cm. This seat mat is equipped with safety on the right and left with a length of 35 cm, and there are recesses to adjust the angle of the backrest so that it can be adjusted as needed. This folding seat mat can be folded for easy storage. The level of comfort for the elderly when using the Folding Seat is in the very good category.

Sandeep Kumar, (2018), the need for wheelchair is especially present in case of immovable people (people with persistent vegetative state, paraplegia, stroke and spinal cord injuries), where the care requires a lot of time and labour. This model can be used in hospitals and in emergency cases and for the patients suffering from Paralysis, Back problems and in emergency cases. The processes used in this project are welding, cutting, grinding, centering, drilling, punching etc. Mostly the material used is mild steel and hollow pipes of stainless steel. The teamwork, planning, execution, guidance and support leads to the efficient completion of this project. At last it can be concluded that this basic model can be used in emergency cases too. It can be a boon for patients, working staff and hospitality management. The cost of our model was very low (approximately 50%) as compared to the same product available in the market. Our work will be very useful for students of Engineering.

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Dhiraj V. Astonkar and Dr. Sanjay M. Kherde, (2015), presented the 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.

Amol M. Kolhe & Samir J. Deshmukh, (2012), presented the found that there is inadequate seating in various public and private spaces. So, more than likely, people are left standing for extending periods of time while waiting in line, waiting for public transportation like bus, train, waiting at entertainment and spectator venues, and similar situations. Extending standing, while unpleasant for most, is often not recommended for certain groups, such as the elderly or those with chronic conditions. 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.

Dale Spendlove and L. E. Tom Atkins, (2001), A folding chair has a Support frame with a back Support portion and first and Second Side Supports extending to form Smith. Frame, and configured to pivot downwardly with respect to the Support frame. First and Second rear legs each have an upper member pivotally coupled to a lower member. The lower members are pivotally coupled to the Support frame, and the upper members are pivotally coupled to the Seat, Such that the first and Second rear legs include three pivot points and the rear legs fold onto themselves to a shorter length in a closed position. First and second folding Systems link the Support frame, the fold-down Seat, and the rear legs together. The first and Second folding Systems including four-bar linkage Systems with four pivot points and four linkages. At least one Stopping member is coupled to the four-bar linkage System shaped and positioned to engage at least one of the linkages of the folding System in an opened unfolded position to provide a limited opened position.

4. OBJECTIVES:

- To study the feasibility of foldable chair.
- To make the prefeasibility analysis
- To assess the technical feasibility of a foldable chair system
- To evaluate a strategy to optimize the size of the foldable chair.

5. METHODOLOGY

5.1 Block Diagram:

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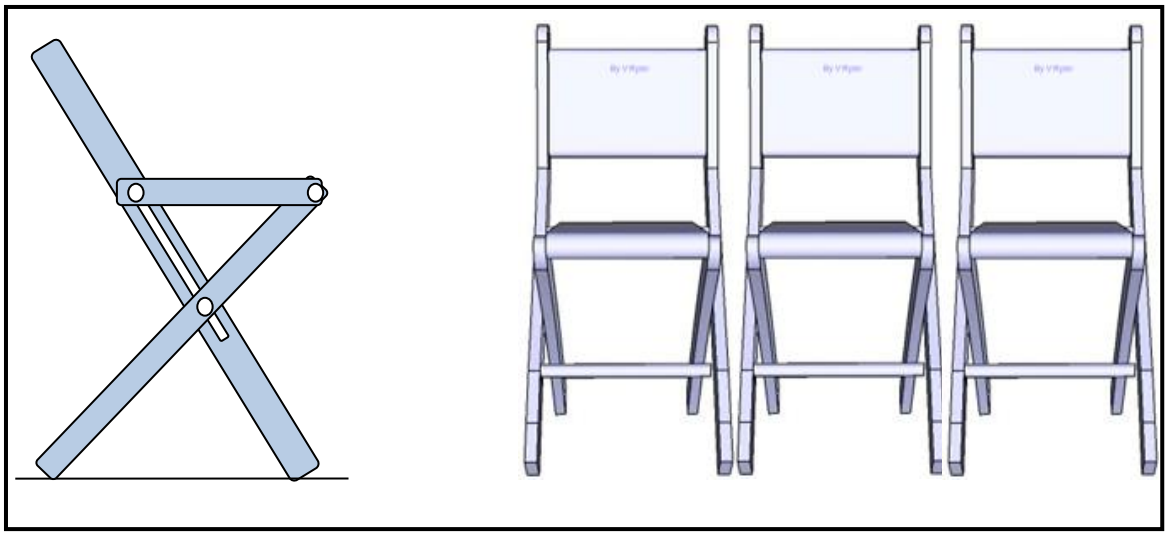

5.2. Manufacturing Processes

5.2.1 Measurement of the material required dimension:

Measurement is the foundation of scientific inquiry. In order to test our hypotheses, we must observe our theoretical concepts at the operational level. In simple words, we must measure what we have defined. But there are different levels of measurement, which provide differing amounts of information about the theoretical construct. There are also some basic issues about the adequacy of measurement which we must address.

5.2.2 Cutting operation as per dimension:

Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping (or planning), broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting.

5.3.3 Machining operation on required parts:

Turning is a cutting operation in which the part is rotated as the tool is held against it on a machine called a lathe. The raw stock that is used on a lathe is usually cylindrical, and the parts that are machined on it are rotational parts – mathematically, each surface machined on a lathe is a surface of revolution. Machining is an essential process of finishing by which work pieces are produced to the desired dimensions

5.2.4. Drilling and tapping the material as per dimension:

These four methods all produce holes of different types. Drilling produces round holes of different types; reaming is used to improve the dimensional tolerance on a drilled hole; boring uses a special machine operating like a lathe, to cut high precision holes; and tapping creates screw-threads in drilled holes. Drilling: The geometry of the common twist drill tool (called drill bit) is complex; it has straight cutting teeth at the bottom – these teeth do most of the metal cutting, and it has curved cutting teeth along its cylindrical surface.

5.2.5. Welding the material as per dimension:

Welding is a process for joining two similar or dissimilar metals by fusion. It joins different metals/alloys, with or without the application of pressure and with or without the use of filler metal. The fusion of metal takes place by means of heat. The heat may be generated either from combustion of gases, electric arc, electric resistance or by chemical reaction. During some type of welding processes, pressure may also be employed, but this is not an essential requirement for all welding processes. Welding provides a permanent joint but it normally affects the metallurgy of the components. It is therefore usually accompanied by post weld heat treatment for most of the critical components. The welding is widely used as a fabrication and repairing process in industries. Some of the typical applications of welding include the fabrication of ships, pressure vessels, automobile bodies, off-shore platform, bridges, welded pipes, sealing of nuclear fuel and explosives, etc. Most of the metals and alloys can be welded by one type of welding process or the other.

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5.2.6. Grinding the project welding joints:

There are several types of grinding machines. The main ones are surface grinders, grinding wheels, cylindrical grinders and center less grinders. The figure below shows examples of a few of these. Surface grinders produce flat surfaces. To improve dimension control on cylindrical parts, center less grinders, which use long cylindrical wheels, are employed. The axis of the regulating wheel and grinding wheel are slightly misaligned, causing the part to travel slowly in the axial direction, and after some time, the part automatically moves beyond the length of the wheel. Controlling the angle of misalignment can control the time that the part is subjected to grinding. If a turned part of complex shape (e.g. stepped shafts) are to be ground, then cylindrical grinding is used, which employs specially made grinding wheels, whose profile fits the profile of the part to be ground.

6. FUTURE SCOPE

The project has covered almost all the requirements. Further requirements and improvements can easily be done since the as per requirements is mainly structured or modular in nature. Improvements can be appended by changing the existing modules

Future scope/outcomes regarding this project work will be:

- Another material may be selected for light weight.
- Motor may be added for lifting the weight instead of applying manual force. Another mechanism may be adopted.

7. 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 kinds 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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