FABRICATION OF STEP CLIMBING WHEEL CHAIR

A PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

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M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

BONAFIDE CERTIFICATE

Certified that this project report **"FABRICATION OF STEP CLIMBING WHEEL CHAIR "** is the bonafide work of **"AKHIL S KUMAR (927622BME001), ANTONY RUFUES C (927622BME002), ARAVINDH S (927622BME003)"** who carried out the project work during the academic year 2023 – 2024 under my supervision. Certified further, that to the best of my knowledge the work ported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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This project report has been submitted for the end semester project viva voce Examination held on _____

INTERNAL EXAMINER EXTERNAL EXAMINE

DECLARATION

We affirm that the Project titled **"FABRICATION OF STEP CLIMBING WHEEL CHAIR"** being submitted in partial fulfillment of for the award of Bachelor of Engineering in Mechanical Engineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis of which a degree or award was conferred on an earlier occasion onthis or any other candidate.

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INSTITUTION VISION & MISSION

Vision

- To emerge as a leader among the top institutions in the field of technical education.

Mission

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality education to the students.
- Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

DEPARTMENT VISION, MISSION, PEO, PO & PSO

Vision

- To create globally recognized competent Mechanical engineers to work in multi cultural environment.

Mission

- To impart quality education in the field of mechanical engineering and to enhance their skills, to pursue careers or enter into higher education in their area of interest.
- To establish a learner-centric atmosphere along with state-of-the-art research facility.
- To make collaboration with industries, distinguished research institution and to become a centre of excellence

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduates of Mechanical Engineering will be able to

- PEO1: Graduates of the program will accommodate insightful information of engineering principles necessary for the applications of engineering.
- PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry.
- PEO3: Graduates of the program will have practical experience and interpersonal skills to work both in local and international environments.
- PEO4: Graduates of the program will possess creative professionalism, understand their ethical responsibility and committed towards society.

PROGRAM OUTCOMES

The following are the Program Outcomes of Engineering Graduates: Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwrite effective reports and design documentation, make effective presentations, and giveand receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of
13. Technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The following are the Program Specific Outcomes of Engineering

Graduates: The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and develop innovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinary areas andmake quality projects.

Research oriented innovative ideas and methods: To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems

Course Outcomes	At the end of this course, learners will be able to:	**Knowledge Level**
CO-1	Identify the issues and challenges related to industry, society and environment.	Apply
CO-2	Describe the identified problem and formulate the possible solutions	Apply
CO-3	Design / Fabricate new experimental set up/devices to provide solutions for the identified problems	Analyses
CO-4	Prepare a detailed report describing the project outcome	Apply
CO-5	Communicate outcome of the project and defend by making an effective oral presentation.	Apply

MAPPING OF PO & PSO WITH THE PROJECT OUTCOME

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO - 1	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 2	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 4	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 5	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3

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CHAPTER 1

ABSTRACT

Many people are suffering of temporary or permanent disabilities due to illnesses or accidents. For cases of difficult or impossible walking, the use of a wheelchair is becoming essential. Manual or electrical wheelchairs are satisfying for most of the low and medium level disability case where patients can use the wheelchair independently. However, in severe cases, it is difficult or impossible to use wheelchairs independently. In such cases wheelchair users often lack independent mobility and rely on somebody else handle the wheelchair. Researchers involved in wheelchair are aiming at designing simple activated wheelchairs to solve such problems. In our model for user friendly handling levers are incorporated which is controlled by a manual effort .This setup increases the efficiency of wheel chair handling and also it gives additional support to the physically challenged person not to depend on some one for their mobility.

CHAPTER 2

INTRODUCTION

According to the World Health Organization's report on disability, currently about 15 percent of world population lives with some type of disability of whom 2-4 percent experience significant difficulties in functioning. The global disability prevalence is higher than previous WHO estimates, which date from the 1970s and suggested a figure of around 10 percent. This global estimate for disability is on the rise due to population ageing and the rapid spread of chronic diseases, as well as improvements in the methodologies used to measure disability. About 80 percent of the disable people live in developing countries as declared by the United Nation Development Program (UNDP).According to study report of census 2011 of India, the majority of population by the type of disability in seeing, hearing, speech, movement, mental retardation, multiple disabilities etc. lies in movement which is about 20.5 percent. Psychologically, reduction in the mobility can lead to feelings of emotional loss, reduced self-esteem, isolation, stress, and fear of abandonment. Multiple sclerosis and arthritis patients have severe disabilities and cannot drive joystick operated wheel chairs .The proposed wheel chair has been specially made for the purpose of eliminating high cost and to provide multi-controls. As a brain wave sensor controlled wheel chair, this wheel chair can be utilized well in many commercial applications. Here the brain wave sensing process is performed by an electronic control unit and as per the received feedback signal from the sensor, motors are activated to move the wheel chair from its rest to motion. So, such a smart wheel chair which functions based upon the feelings of operator can bring transition and thus happiness in the life of disable people.

CONSTRUCTION

The chassis of wheel chair is constructed with the help of square tubes and channels by metal cutting and metal joining process called welding. At the rear end of chassis frame two star wheel arrangement is mounted with the help of bearing support in order to attain friction free rotation. At the front end two supporting wheels are mounted for travelling in flat surface as well as it also consists of star wheel arrangement for stair climbing applications.. The seating arrangement is provided on the chassis which helps the user to experience comfortable driving.

LITERATURE REVIEW

Channabasavaraj B D , Ganesh N , Sachin N , Sumanth G Vaidya

Stair Climbing Wheel Chair

A concept for a stair climbing wheel chair capable of moving in structured and unstructured environments, climbing over obstacles and going up and down stairs. The design of the wheelchair consisting of a frame, a seat and a six DC geared motor linkage mechanism that connects frame and seat. The six DC geared motor linkage moves and rotates the belt, the wheel chair from overturning and to guarantee a comfortable posture to the passenger during different operations. When the wheelchair faces an obstacle such as a step or a stair, it can passively change locomotion mode, from rolling on wheels.

M.J. Lawn T. Ishimatsu

Modeling of a stair-climbing wheelchair mechanism with high single-step capability

In the field of providing mobility for the elderly and disabled, the aspect of dealingwith stairs continues largely unresolved. This paper focuses on presenting the development of a stair-climbing wheelchair mechanism with high single-step capability. The mechanism is based on front and rear wheel clusters connected to the base (chair) via powered linkages so as to permit both autonomous stair ascent and descent in the forward direction, and high single-step functionality for such as direct entry to and from a van. Primary considerations were inherent stability,

provision of a mechanism that is physically no larger than a standard powered wheelchair, aesthetics, and being based on readily available low-cost components.

Maruti Khot Anurag Gumaste , Varsha Jagdale

DESIGN AND DEVELOPMENT OF STEP CLIMBING WHEEL CHAIR

Nowadays autonomy in the area of mobility is accepted to be of high value which may be sometimes hampered due to some form of disability. Hence, wheelchairs continue to play a vital role to allow for mobility of the disabled people. But this autonomy is not applicable in environments having steep slopes or staircase. Thus,a wheelchair having staircase climbing ability could be the remedy. Additionally, such a wheelchair could also provide an easy means of transport for patients in hospitals. An attempt has been made to design such a wheelchair that will provide increased mobility in environments with staircases and steep slopes. The different mechanisms have been analyzed and compared to select the most suitable mechanism. The mechanism thus chosen has been modeled and analyzed using SOLIDWORKS computer software. The aim of this paper is to present a mechanism for staircase climbing of wheelchair and to analyze the effectiveness ofthe same. After making the necessary design changes, a prototype of the wheelchair is developed

M.R. Kushte O.S. Dalvi R.R. Date A.V. Shelar Asst. Prof. A.A Kumbhar

Design & Fabrication of Staircase Climbing Wheelchair using Conveyor Belt Mechanism

From 18 century many types of wheelchair had been designed, by developing its functionality. This project involves an ergonomically design and fabrication of anstair climbing functionality will be upgraded by changing its structure designand

mechanism. The important parts of this product are conveyor belt, frame and driving mechanism climbing wheelchair for regular use by old disabled people.. The design of frame will be done by considering various loads, stresses at various positions. The main factor of wheelchair is laid on the angle of stair and center of gravity of whole system. Understanding the different issues regarding the functionality of wheelchair and introducing a advanced design that will be an as help for the medical field and a helping hand for disabled people.

Urvashi Singh, Aditya Singh, Leroy Fernandes, Olinda Noronha , Rishi Parvanda Design and Fabrication of Stair Case Climber for physically challenged person

The project deals with designing and manufacturing of a manually operated staircase climber which can be used for both leveled plane as well as staircases. The major concern in this project was to provide stability to the person who is travelling in it and simultaneously maintaining the overall centre of gravity as low as possible. Keeping the above mention criteria in mind all calculations was performed. The model was designed using SOLIDWORKS and subsequent analysis was done using ANSYS software. This project will assist physically disabled people in their daily lives and it will be quite useful in rural and semi-urban areas. The overall cost of the project is certainly low as compared to the commercially available staircase climbers

CHAPTER 3

WORKING PRINCIPLE

Staircase climbing manual wheelchairs are specialized devices designed to assist individuals with mobility impairments in navigating staircases, especially in situations where ramps or elevators are not available. While there are different designs and mechanisms for such wheelchairs, a common working principle involves the use of a tracked or leveraged system. Here's a general overview of the working principle for a staircase climbing manual wheelchair:

1. **Track or Lever System:** Staircase climbing wheelchairs typically have a mechanism that allows them to navigate stairs. One common approach is the use of tracks or levers that make contact with the steps, providing a means for the wheelchair to ascend or descend.

2. **Manual Operation:** These wheelchairs are manually operated by the user or acaregiver. The individual in the wheelchair or their attendant controls the movement of the wheelchair on the stairs, guiding it up or down.

3. **Adjustable Stabilizers:** To ensure stability during stair climbing, these wheelchairs often have adjustable stabilizers or supports. These may be extended or retracted as needed to maintain balance and prevent tipping.

4. **Transfer of Weight:** The wheelchair user or caregiver needs to shift their weightappropriately to facilitate the movement of the wheelchair on the stairs.

This weight transfer, combined with the design of the wheelchair and its stair-climbing mechanism, helps navigate the steps safely.

5. **Lightweight and Durable Construction:** Stair-climbing wheelchairs are designedto be lightweight yet durable. The materials used in construction should be strong enough to withstand the stresses of climbing stairs while keeping the overall weight of the wheelchair manageable for manual operation.

6. Portable Seat Design: Many stair-climbing wheelchairs are designed to be easily disassembled for convenient transportation and storage our wheel chair is designed to be converted as the user's multipurpose wheelchair. This feature enhances the wheelchair's portability and makes it more practical for everyday use.

Height adjustment mechanism:(Rack and pinion Mechanism)

A rack and pinion mechanism is a type of linear motion device that converts rotational motion into linear motion. It consists of two main components: a gear (pinion) and a linear rack. This mechanism is commonly used in various applications, such as steering systems in vehicles, CNC machines, robotics, and other machinery where precise linear motion is required. Here's an overview of how the rack and pinion mechanism works:

1. Pinion (Gear):
   - The pinion is a small, circular gear with teeth on its circumference.
   - It is typically mounted on a rotating shaft, such as a motor or a steering column.
   - As the pinion rotates, it engages with the teeth on the rack.
2. Rack:
   - The rack is a straight, flat bar or rail with teeth along its length.
   - The teeth on the rack mesh with the teeth on the pinion.
   - The rack is fixed in place or moves linearly along a guided path.

CHAPTER 4

MAJOR COMPONENTS

1. SHEET METAL

2. CHAIN SPROCKET

3. SHAFT

4. WHEEL

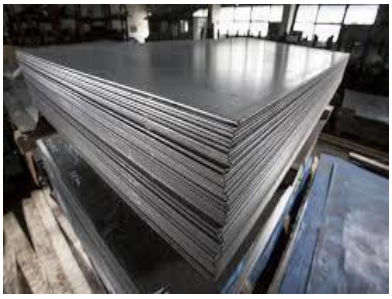
5. METAL STRIP

6. BEARING

7. HAND LEVER

8. FRAME

SHEET METAL



Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes.

Sheet metal is available in flat pieces or coiled strips. The coils are formed by running a continuous sheet of metal through a roll slitter.

There are many different metals that can be made into sheet metal, such as aluminum, brass, copper, steel, tin, nickel and titanium. For decorative uses, important sheet metals include silver, gold, and platinum (platinum sheet metal is also utilized as a catalyst.)

Sheet metal is used in automobile and truck (lorry) bodies, airplane fuselages and wings, medical tables, roofs for buildings (architecture) and many other applications. Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications in transformers and electric machines.

Sheet metal is used to make the table.

Material - Mild steel

Size - 40*22cm

Thickness - 2mm

SPROCKET

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the **drive chain** or **transmission chain**, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotate once, it causes the gear that drives the wheels to rotate more than one revolution.

Characteristics:

- High axial stiffness
- Low bending stiffness
- High efficiency
- Relatively cheap

SPECIFICATION OF AXLE:

Material	**Mild Steel**
Shape	Cylindrical rod
Length	50mm
Diameter	13mm
Inner diameter of supporting axle	15 mm
Outer diameter of supporting axle	17mm
Length	30mm
Thickness	3mm

CHAIN SPROCKET:

Material	High Carbon Steel
Pitch	12.7mm
Width	30mm
Teeth	16
Balls	High carbon high chromium steel balls

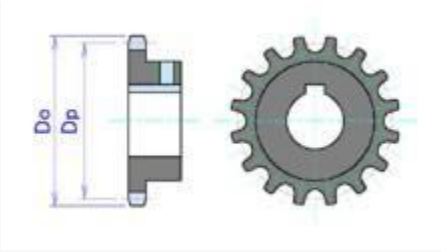
Inertial force in chain:

- In addition to the tension required to transmit power, chain tension
- also provides centripetal force to move links around sprockets

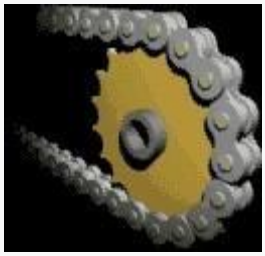
A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never

meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel . Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.



16 tooth sprocket. Do = Sprocket diameter. Dp = Pitch diameter



Sprockets are of various designs, a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

SHAFT

Specifications:

Shaft diameter: 12mm

Material: mild steel

Length:24 inch

Shaft :

Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission. The shaft is generally acted upon by bending moment, torsion and axial force. Design of shaft primarily involves in determining stresses at critical point in the shaft that is arising due to aforementioned loading. Other two similar forms of a shaft are axle and spindle. Axle is a non-rotating member used for supporting rotating wheels etc. and do not transmit any torque. Spindle is simply defined as a short shaft.

Design considerations for shaft :

For the design of shaft following two methods are adopted, Design based on Strength In this method, design is carried out so that stress at any location of the shaft shouldnot exceed the material yield stress. However, no consideration for shaft deflection and shaft twist is included. Design based on Stiffness Basic idea of design in such case depends on the allowable deflection and twist of the shaft.

Specifications:

Shaft diameter: 12mm

Inner Diameter: 10mm

Material: mild steel

METAL STRIP

Specifications:

Length: 50cm

Width: 5cm

Thickness: 4mm

Metal strip is narrow, thin stock that is usually 3/16 in. (4.76 mm) or less in thickness and under 24 in. (609.6 mm) in width. Metal strips are formed to precise thicknesses and/or width requirements.

How Metal Strip is made?

Metal strip can be designed and manipulated through a large number of processes which are grouped into categories. They are joining and assembly processes, deformation processes, material removal processes, heat treating processes, and finishing processes.

BALL BEARING

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races.

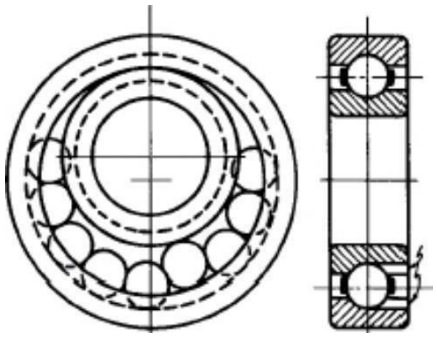
The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.

SPECIFICATION:

INNER DIAMETER :12mm

OUTER DIAMETER : 37mm



AXIAL:

An axial or thrust ball bearing uses side-by-side races. An axial load is transmitted directly through the bearing, while a radial load is poorly supported and tends to separate the races, so that a larger radial load is likely to damage the bearing.

ROWS:

There are two row designs: single-row bearings and double-row bearings. Most ball bearings are a single-row design, which means there is one row of bearing balls. This design works with radial and thrust loads.

A double-row design has two rows of bearing balls. Their disadvantage is theyneed better alignment than single-row bearings.

OPERATING CONDITION

LIFESPAN:

Further information: Rolling-element bearing & Bearing failure

The calculated life for a bearing is based on the load it carries and its operating speed. The industry standard usable bearing lifespan is inversely proportional to the bearing load cubed. Nominal maximum load of a bearing, is for a lifespan of 1 million rotations, which at 50 Hz (i.e., 3000 RPM) is a lifespan of 5.5 working hours. 90% of bearings of that type have at least that lifespan, and 50% of bearings have a lifespan at least 5 times as long.

FAILURE MODES:

If a bearing is not rotating, maximum load is determined by force that causes plastic deformation of elements or raceways. The indentations caused by the elements can concentrate stresses and generate cracks at the components. Maximum load for not or very slowly rotating bearings is called "static" maximum load. If a bearing is rotating, but experiences heavy load that lasts shorter than one revolution, static max load must be used in computations, since the bearing does not rotate during the maximum load.

MAXIMUM LOAD:

In general, maximum load on a ball bearing is proportional to outer diameter of the bearing times the width of the bearing (where width is measured in direction of axle).[7]

Bearings have static load ratings. These are based on not exceeding a certain amount of plastic deformation in the raceway. These ratings may be exceeded by a large amount for certain applications.

LUBRICATION:

For a bearing to have its nominal lifespan at its nominal maximum load, it must be lubricated with a lubricant (oil or grease) that has at least the minimum dynamic viscosity

If the viscosity of lubricant is higher than recommended, lifespan of bearing increases, roughly proportional to square root of viscosity. If the viscosity of the lubricant is lower than recommended, the lifespan of the bearing decreases, and by how much depends on which type of oil being used.

DIRECTION OF LOAD:

Most bearings are meant for supporting loads perpendicular to axle ("radial loads"). Whether they can also bear axial loads, and if so, how much, depends on the type of bearing. Thrust bearings (commonly found on lazy susans) are specifically designed for axial loads.

For single-row edge-contact ball bearings, axial load can be about 2 times max radial load, and for cone-bearings maximum axial load is between 1 and 2 times maximum radial load.

HAND LEVER

Material: Mild Steel

METAL FRAME

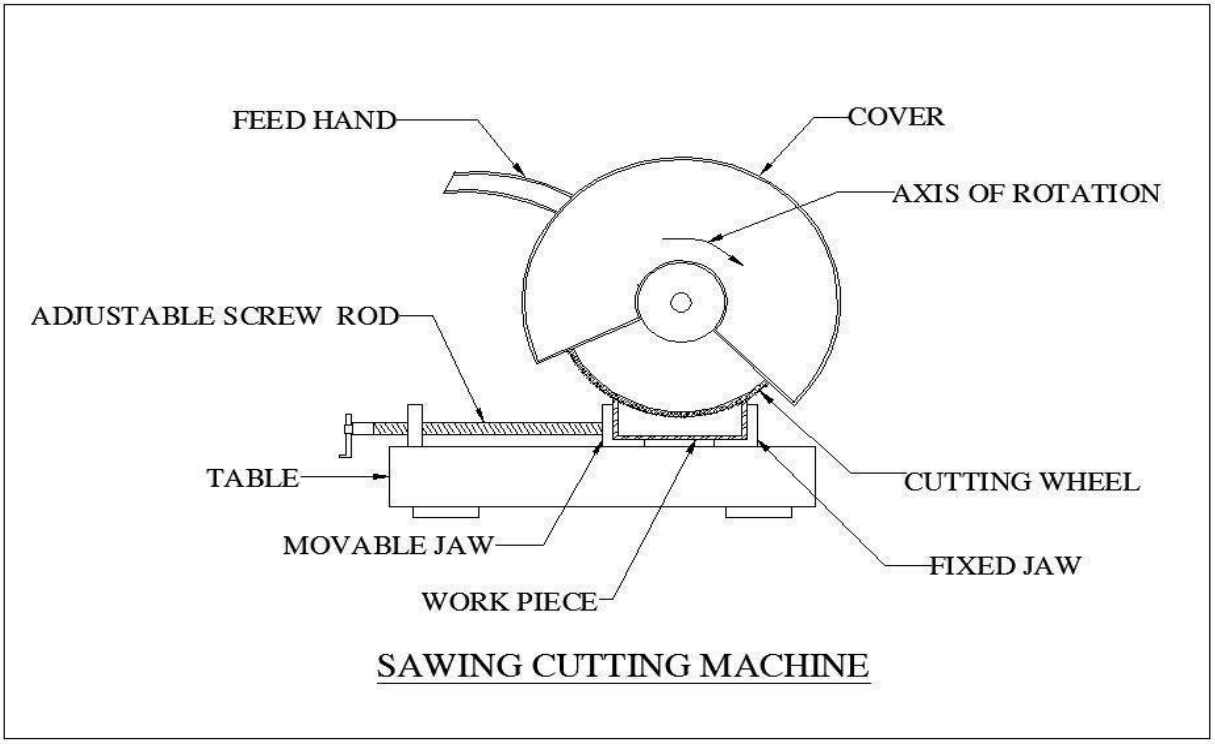
The metal frame is generally made of **mild steel** bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. It can be case-hardened to improve wear resistance. They are available in bright rounds, squares and flats, and hot rolled rounds

Suitable machining allowances should therefore be added when ordering. It doesnot contain any additions for enhancing mechanical or machining properties. Bright drawn mild steel is an improved quality material, free of scale, and has been cold worked (drawn or rolled) to size. It is produced to close dimensional tolerances. Straightness and flatness are better than black steel. It is more suitable for repetition precision machining. Bright drawn steel has more consistent hardness, and increased tensile strength. Bright steel can also be obtained in precision turned or ground form if desired.

SAWING:

Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered with electricity and is usually a stationary type of saw machine rather than a portable type of saw.

The circular saw blades used with a cold saw are often constructed of high speed steel. Steel blades of this type are resistant to wear even under daily usage. The end result is that it is possible to complete a number of cutting projects before there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal.

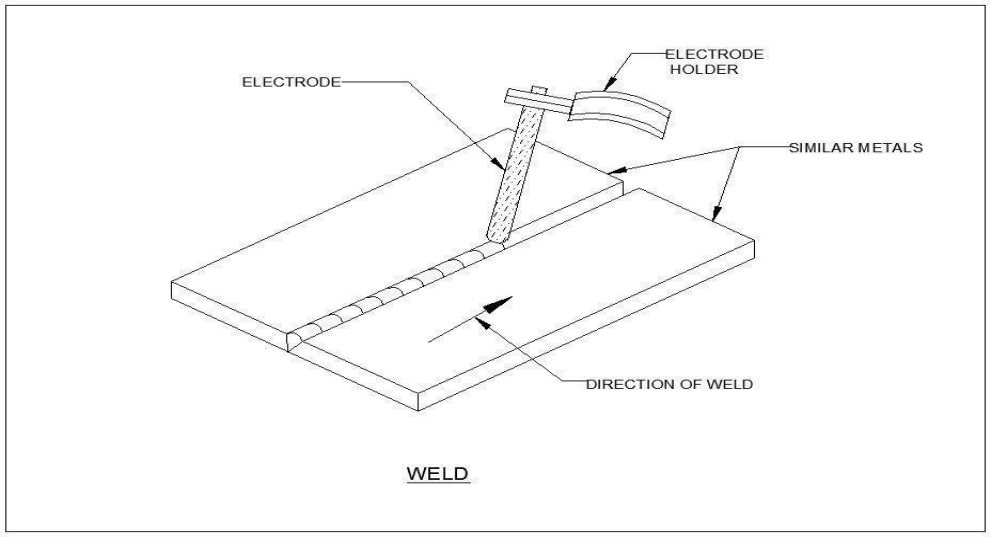


SAWING CUTTING MACHINE

WELDING:

Welding is a process for joining similar metals. Welding joins metals by melting and fusing **1,** the base metals being joined and **2,** the filler metal applied. Welding employs pinpointed, localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined.

Welding is used for making permanent joints. It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building



DRILLNG:

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips (sward) from the hole as it is drill

CHAPTER 5

ADVANTAGES AND APPLICATIONS

ADVANTAGES

- **Mobility –** Chances are over a span of years, your mobility has become increasingly affected and your activities have lessened, resulting in a lifestyle that is mainly spent indoors. Wheelchairs provide you freedom to move around as you wish.
- **Independence –** You may have a difficult time walking and need to frequently lean on someone or hold onto their arm as they walk next to you. You may have fear to walk within your home while you are alone or have a fear of falling. This type of fear can cause you to become isolated from friends and family
- **Comfort –** Many wheelchairs provide support for your back and comfortable seating. You will be able to be seated comfortably with strong support that encourages good posture.
- **Increased Socialization –** When you have a wheelchair, you have a new sense of freedom that allows you to safely and comfortably enjoy life. Visiting friends and participating in social activities and clubs are all possible when you have a wheelchair.

APPLICATION

The applications of stairs climbing wheel chair are

- It is used for physically challenged people.
- It is used travel from one place another in structured or unstructured environments.
- It may be used in hospital for patients.

CHAPTER 6

MATERIAL USED

S.No	DESCIRPTION	QTY	MATERIAL
1	CHAIN SPROCKET	2	SS
2	SHEET METAL	1	MILD STEEL
3	BEARING	30	STAINLESS STEEL
4	FRAME	AS PER REQUIREMENT	MILD STEEL
5	SHAFT	AS PER REQUIREMENT	MILD STEEL
6	METAL STRIP	AS PER REQUIREMENT	MILD STEEL
7	WHEEL CHAIR	1	MILD STEEL
8	HAND LEVER	1	MILD STEEL
9	WHEEL	1	PLASTIC

CHAPTER-7

COST ESTIMATION

S.NO	DISCRIPTION	COST Rs:
1	CHAIN SPROCKET	700
2	SHEET METAL	500
3	BEARING	250
4	FRAME	600
5	SHAFT	800
6	METAL STRIP	1000
7	HAND LEVER	900
8	WHEEL	250
9	TOTAL	5000

LABOUR COST

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW, GAS CUTTING:

Cost = 1000/-

TOTAL COST:

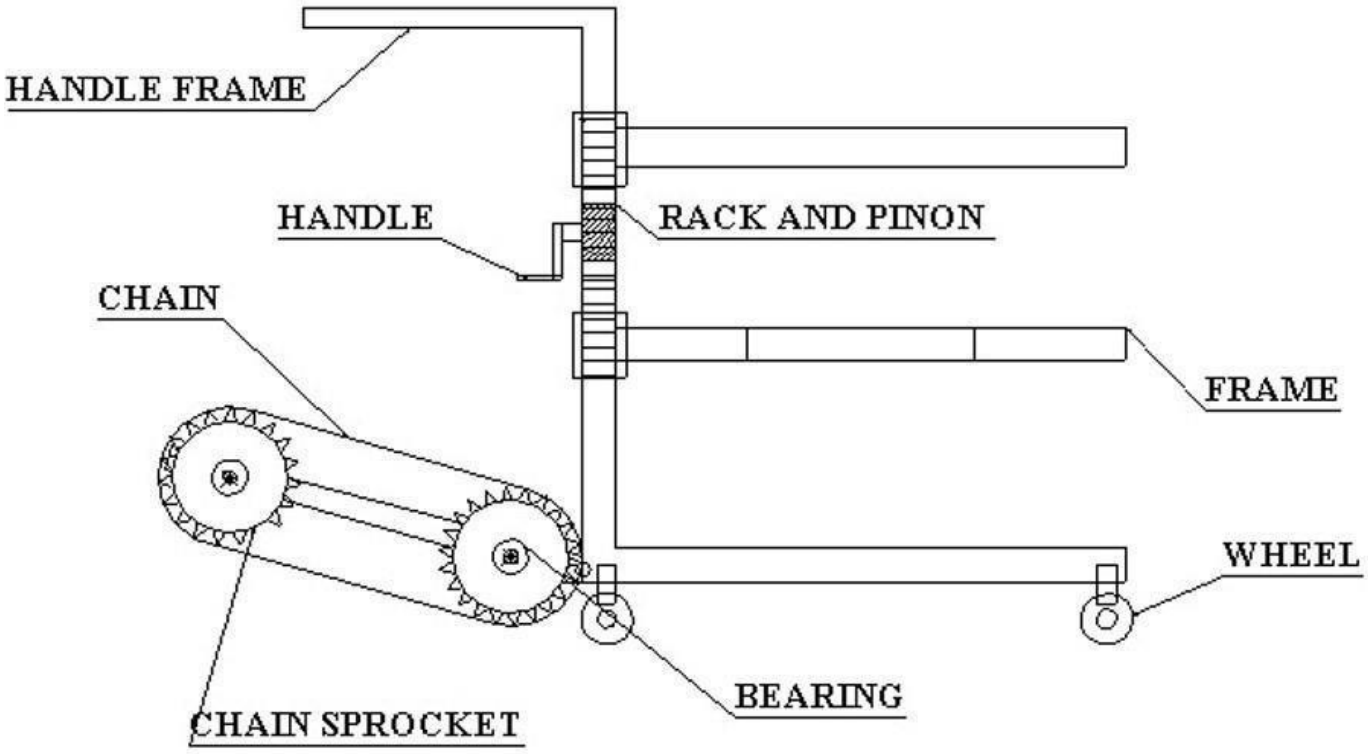
Total cost = Material Cost + Labour cost

= Rs 5000 + 1000

Total cost for this project = Rs 600

CHAPTER 8

2D LAYOUTS OF MODEL



CHAPTER 9

PHOTOGRAPH


Neelpankh

CHAPTER 10

CONCLUSION

This designed stair climbing wheelchair can climb up stairs up to angle of 30 degree. In this wheelchair rubber crawler provide proper grip on step while climbing up stair cases. It can be operated by handicapped person without help of any person. It can also climb maximum step height up to 180 mm. This track basedwheel chair is not depending upon the tread width no matter tread how much long but it can climb up stair case angle up to 30 degree. Maximum payload was 80 kg. It can travel on rough as well as flat surface. In layman terms, some future steps have been proposed and some practical steps have been taken towards even better steps for human and humankind a vision of providing mobility equality for all. As paper conclude that Disabled people are increasingly able to lead an independent life and play a more productive role in society with the help of stair climbing wheelchair. Combined with the computed torque method, a novel control law applied to holonomic or non-holonomic systems is derived, with the active tensionof the track controlled for WT wheelchair robot during the stair-climbing process simultaneously. The simulation of each of output and each expected reference input of the generalized coordinate shows the effectiveness of the proposed controllaw, the experimental results of the stair-climbing process for wheelchair robot verifying its obstacle-navigating performance, and the patterns analyzed above areembodied in the experiment.

CHAPTER-11

REFERENCE

1. Giuseppe Quaglia, Walter Franco and Riccardo Oderio, Motorized wheel chair with stair climbing ability, International Journal of Innovation Of Machine And Materials, 46(11), 2009, 1601-1609.
2. Murray J Lawn and Takakazu Ishimatsu, Modeling of a stair climbing wheel chair mechanism with high single step capability International journal of Robotics and Machines, 11(3), 2003, 323-332
3. . Simpson RC, LoPresti E, Cooper RA (2008). How Many People Would Benefit from a Smart Wheelchair? Journal of Rehabilitation Research and Development, 45(1), 2008, 53-72
4. Morales R, Gonzalez A, Feliu V, Pintado P Environment adaptation of a new staircase-climbing wheelchair, Autonomous Robots Journal, 23(10), 2007, 3995-4001.
5.]Murray John Lawn, Study of stair-climbing assistive mechanisms for the disabled, PhD Thesis, Japan, (2002).
6. Kan Yoneda, Yusuke Ota, Shigeo Hirose, Stair Climbing Robots and High Grip Crawler, In Tech Publishers, (2010).
7. Lawn MJ, Ishimatsu T. Modeling of a stairclimbing wheelchair mechanism with high single-step capability. IEEE Trans Neural Syst Rehabil Eng. Volume 11, issue 3, (2003), 323- 332.
8. R Rajasekar, K P Pranavkarthik, R Prashanth, S Senthil Kumar and A Sivakumar, Design and Fabrication of Staircase Climbing Wheelchair, IJMRRR, (2013), 320-323.

9. Ralston H J., Energy speed relation and optimal speed during level walking, Int Z Angew Physiol (1958) 277-283.
10. Mark Snaterse, Robert Ton, Arthur D. Kuo and J. Maxwell Donelan. Distinct fast and slow processes contribute to preferred step frequency during human walking, J Appl Physiol (2011), 1682-1690.
11. Lin Zhang, Xi Feihong, An optimization design for the stair climbing wheelchair, M.Sc. Thesis, Blekinge Institute of Technology, Sweden (2012).
12. S R Rajasekar et al., "Design and fabrication of staircase climbing wheelchair", International Journal of Mechanical Engineering and Robotic Research.(IJMER), Volume 02, Issue 02, April 2013.
13. Sreerag C et al., "Design and Development of Conceptual Wheelchair Cum Stretcher", SASTECH, Volume 10, Issue 02, Sept 2011.
14. Rashid Ahmed Khan et al., "Design and Fabrication of Pneumatically Powered Wheel Chair-Stretcher Device" International Journal of Innovative Research in Science, Volume 02, Issue 10, October 15.
15. Shashank Shekhar Sahoo et al. "Research on Optimization, Dynamics and Stability of Stair-climbing Wheelchair" Int. Journal of Engineering Research and Applications, Volume 6, Issue 3, (Part - 1) March 2016.
16. N.N. Sorate et al., "Stair Climbing Wheelchair for Disabled Person", International Journal of Mechanical and Industrial Technology ISSN 2348-7593 (Online) Volume 03, Issue 02,. March 2016
17.. Paul P.Weyer 12345 SE.160th St., Renton, Wash," Wheelchair for regular and irregular surface travels" Ser No. 248,738 Dec 31, 1962.