DESIGN AND FABRICATION OF HUMAN BACK WASHER

A PROJECT REPORT

Submitted by

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in partial fulfilment for the award of the degree

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BONAFIDE CERTIFICATE

Certified that this project report titled "**DESIGN AND FABRICATION OF HUMAN BACK WASHER"** is the bonafide work of **SIVA SANKARAN.N(811721114047),SIVASANKAR.M(811721114048),SRIRAM.E(811721114049),VIBILAN.V.G(811721114059),**who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported herein 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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INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

We jointly declare that the project report on "**DESIGN AND FABRICATION OF HUMAN BACK WASHER"**is the result of original work done by us and best of our knowledge, similar work has not been submitted to **"K RAMAKRISHNAN COLLEGE OF TECHNOLOGY"** for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfilment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING**.

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ABSTRACT

It is difficult wash our posterior back by our self, by using only our hands we cannot wash it easily. So we are making a machine which is attached to the toilet which do not need an individual space for setup. A certain number of rollers are connected and being rotated by a motor and it will start to rotate. An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the solid rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates.

KEY WORDS: Electric motor , Posterior back , Gears , Meshed with, Frame . Rod

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ABREVATION

SYMBOLS	ABREVATION
cm	Centimeter
kg	Kilogram
mm	Millimeter
hrs	Hours
w	Watt

CHAPTER 1

INTRODUCTION

1.1.HUMAN BACK WASHER

It is difficult for us to wash the Posterior back of our body while bathing. Although we are using some back scrubber belt for washing our back it's a quite difficult one. Alternatively buying a scrubber should be placed in wall and we should rub our back manually and it also require a individual space for setup. So we are making a machine which is attached to the toilet which do not need an individual space for setup. A certain number of rollers are connected and being rotated by a motor and it will start to rotate. An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the hollow rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates. The sponge is added to the connected shaft because the sponge is the soft material so it will not harm our skin because the other materials like scrubber when forcefully rubbed into the skin it will hurt your skin so the sponge is the cheap and best option for this. The sponges are attached to the shaft, so when the shaft rotates with the help of motor when we lie back it will rotate in the posterior back of the body by rubbing your skin. A soap water reservoir is placed on the top of the frame which can be turned ON and OFF manually. The soap water through the hole like structure in reservoir which is connected to the shaft when we turned on the reservoir manually the water slightly flows over the shaft and the sponge starts to absorb the soap water because it can observe the liquid things easily.

1.2.WORKING

An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the hollow rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates. The sponge is added to the connected shaft because the sponge is the soft material so it will not harm our skin because the other materials like scrubber when forcefully rubbed into the skin it will hurt your skin so the sponge is the cheap and best option for this. The sponges are attached to the shaft, so when the shaft rotates with the help of motor when we lie back it will rotate in the posterior back of the body by rubbing your skin. A soap water reservoir is placed on the top of the frame which can be turned ON and OFF manually. The soap water through the hole like structure in reservoir which is connected to the shaft when we turned on the reservoir manually the water slightly flows over the shaft and the sponge starts to absorb the soap water because it can observe the liquid things easily. Now the wet sponge is able to clean the back of the body quite well. The adjustment lever is setted up in the side of the frame through which we can adjust the front and back position it makes us more comfortable. Three rollers are setup in the back and two rollers are placed on the both side and are clamped so the roller can clean the back easily this is the very simple mechanism which can be easily understand by everyone.

The motor is covered by a frame which protects it from being wet so it prevents the electric leakage this is the most essential thing in the regular household products. We cannot wash our back easily so this machine is used to wash our back. the soap water is filled manually which can be turned on and off easily this soap water reservoir should correctly flow over only by the shafts which are attached by the rollers and the water should not leak on it’s own.

When the motor starts to rotate the gear which is at the tip of the motor and the other gears which are meshed with the first gear also rotates with the motor once all the gear starts to rotate the shafts connected to it also start to rotate the sponge a soft material is attached to the shaft also rotates because it is the soft material which don’t do any harness or hurt to our body because of it soft nature. And the water reservoir is at the top of the frame the water reservoir can be turned on and off manually the water should only flow through the shafts which are connected with the sponge and all the shaft are clamped to it very tightly because it should not fall or departed while rotating so they are clamped tight. And a adjustment lever is place on the side of the frame which allows us to move both front and back which enables the comfort to the users. This is the overall working process for this design.

1.3.NEED FOR HUMAN BACK WASHER

It is difficult wash our posterior back by our self, by using only our hands we cannot wash it easily. So we are making a machine which is attached to the toilet which do not need an individual space for setup. A certain number of rollers are connected and being rotated by a motor and it will start to rotate. When the motor starts to rotate the gear which is at the tip of the motor and the other gears which are meshed with the first gear also rotates with the motor once all the gear starts to rotate the shafts connected to it also start to rotate the sponge a soft material is attached to the shaft also rotates because it is the soft material which don't do any harness or hurt to our body because of it soft nature. And the water reservoir is at the top of the frame the water reservoir can be turned on and off manually the water should only flow through the shafts which are connected with the sponge and all the shaft are clamped to it very tightly because it should not fall or departed while rotating so they are clamped tight. And a adjustment lever is place on the side of the frame which allows us to move both front and back which enables the comfort to the users. This is the overall working process for this design.

1.4.WORKING PRINCIPLE OF SHAFT

A solid shaft refers to a cylindrical bar that is consistent in diameter along its entire length, as opposed to a hollow shaft which has a void or empty space in its center. Rolling a solid shaft typically refers to the process of shaping or forming it into a desired shape or size using various techniques such as machining, forging, or extrusion. Machining involves cutting, drilling, or grinding the shaft to achieve the desired dimensions and surface finish. Forging involves shaping the shaft by applying compressive forces using a hammer or press. Extrusion involves forcing the shaft material through a die to shape it into the desired form. The specific method used for rolling a solid shaft depends on factors such as the material of the shaft, its intended application, and the desired properties of the final product.

1.5.WORKING OF GEAR

When spur gears are horizontally meshed with each other, they transmit rotational motion and power between parallel shafts. Here's a breakdown of how they work:

Gear Teeth Engagement: Spur gears have teeth that mesh with each other when they rotate. The teeth are cut parallel to the gear axis, and they engage smoothly when the gears are in motion.

Force Transmission: As one gear rotates, it causes the teeth of the other gear to engage. This engagement transfers rotational motion from one gear to the other. The teeth are designed to provide a constant velocity ratio between the gears.

Direction of Rotation: The direction of rotation in spur gears is determined by the orientation of the gears and the arrangement of teeth. When two spur gears mesh horizontally, they rotate in opposite directions.

Torque Transmission: The torque is transmitted from one gear to the other through the meshing teeth. The torque on the driven gear (the one receiving the power) is equal to the torque on the driving gear (the one providing the power), assuming ideal conditions without losses.

Speed Ratio: The speed ratio between the two gears is determined by the number of teeth on each gear. The gear with more teeth rotates slower but with higher torque, while the gear with fewer teeth rotates faster but with lower torque.

1.6.WORKING OF BEARING

When a bearing is connected to a rotating shaft, it serves a crucial role in supporting and allowing smooth rotation of the shaft. Here's how it works. Supporting the Shaft: The primary function of a bearing is to support the shaft and any radial or axial loads that act on it. It prevents the shaft from wobbling or vibrating excessively during rotation. Reducing Friction: Bearings are designed to minimize friction between the rotating shaft and stationary components. This is achieved by providing a smooth surface (usually made of metal or a composite material) for the shaft to rotate on.

Types of Bearings: There are various types of bearings, but two common types are sleeve bearings and rolling element bearings.

Sleeve Bearings: Also known as plain bearings or bushings, sleeve bearings consist of a cylindrical sleeve (often made of bronze or other materials) that encircles the shaft. The shaft rotates within the sleeve, and lubrication is typically required to reduce friction and wear.

Rolling Element Bearings: These bearings use rolling elements such as balls or rollers to reduce friction. They consist of an inner race, an outer race, and the rolling elements. As the shaft rotates, the rolling elements roll between the inner and outer races, allowing smooth rotation with minimal friction.

Lubrication: Proper lubrication is essential for the efficient operation of bearings. Lubricants such as oil or grease are used to reduce friction, dissipate heat, and protect against wear. Lubrication also helps to prevent corrosion and extend the lifespan of the bearing.

Load Handling: Bearings are designed to handle various types of loads, including radial loads (perpendicular to the shaft) and axial loads (parallel to the shaft). The design and size of the bearing depend on factors such as the magnitude and direction of the loads, as well as the speed of rotation.

Mounting and Alignment: Proper mounting and alignment of the bearing are critical for its performance and longevity. Incorrect installation can lead to uneven wear, increased friction, and premature failure of the bearing.

1.7.WORKING OF FRAME

In the context of machines and mechanical engineering, a frame refers to a structure that provides support and stability to various components and mechanisms within a machine. Frames are essential for maintaining the integrity of the machine and ensuring that it functions properly under various loads and conditions.

Support and Stability: Frames are designed to support the weight of the machine and any loads it may carry or encounter during operation. They provide a stable platform for mounting components such as engines, motors, gears, and other moving parts.

Resistance to Deformation: Frames are typically constructed from materials such as steel, aluminum, or composite materials that have high strength and stiffness. This helps the frame resist deformation or bending forces that may occur during operation, ensuring that the machine maintains its shape and alignment.

Transmission of Forces: Frames distribute forces and loads throughout the structure, preventing localized stress concentrations that could lead to failure. This ensures that forces generated by the machine's components, such as motors or hydraulic actuators, are effectively transmitted to the ground or other supporting structures.

Alignment and Precision: Frames play a crucial role in maintaining the alignment and precision of moving parts within the machine. By providing rigid mounting points and guiding surfaces, frames help ensure that components such as shafts, bearings, and gears operate smoothly and accurately.

Vibration Damping: Frames can also help dampen vibrations generated by the machine's operation. By absorbing and dissipating vibrational energy, frames reduce noise and prevent excessive wear and tear on components.

Safety: Frames contribute to the overall safety of the machine by providing a protective enclosure for operators and bystanders. Additionally, they help contain any debris or hazards that may be generated during operation.

Overall, frames are fundamental structural components in machines, providing support, stability, and functionality while ensuring safe and reliable operation. Their design and construction are crucial considerations in the development of any mechanical system.

1.8.WORKING OF MOTOR

Electric motors are critical components in various machines and systems, converting electrical energy into mechanical energy. Here's how they work:

Basic Principle: Electric motors operate based on the principle of electromagnetic induction. When an electric current flows through a wire in the presence of a magnetic field, it creates a force on the wire, causing it to move. This principle forms the basis of how electric motors generate motion.

Components:

Stator: The stator is the stationary part of the motor and consists of a series of coils or windings wrapped around a core. When an electric current is passed through these windings, they generate a magnetic field.

Rotor: The rotor is the rotating part of the motor. It is typically mounted on a shaft and placed within the stator's magnetic field. The rotor may have permanent magnets or windings that interact with the magnetic field generated by the stator.

Operation:

Start-up: When an electric current is supplied to the motor, it energizes the stator windings, creating a rotating magnetic field. This magnetic field induces a current in the rotor (if it's a squirrel-cage rotor) or interacts with the permanent magnets on the rotor (if it's a permanent magnet rotor).

Torque Generation: The interaction between the magnetic fields of the stator and rotor creates a force, known as electromagnetic torque, that causes the rotor to rotate. This rotation continues as long as the electric current is supplied to the motor.

Speed Control: The speed of the motor can be controlled by varying the voltage or frequency of the electrical supply, or by using specialized control techniques such as pulse-width modulation (PWM) or variable frequency drives (VFDs).

Types of Motors:

AC Motors: Alternating current (AC) motors are commonly used in various applications. They include induction motors, synchronous motors, and others.

DC Motors: Direct current (DC) motors are also widely used and include brushed DC motors, brushless DC motors, and others. Specialized Motors: There are also specialized types of motors designed for specific applications, such as stepper motors, servo motors, and linear motors.

Applications: Electric motors are used in a wide range of applications, including industrial machinery, household appliances, transportation (e.g., electric vehicles), HVAC systems, robotics, and more.

Overall, electric motors play a vital role in powering machines and systems across various industries, providing efficient and reliable mechanical energy conversion.

1.9.OVERALL WORKING

An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the hollow rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates. The sponge is added to the connected shaft because the sponge is the soft material so it will not harm our skin because the other materials like scrubber when forcefully rubbed into the skin it will hurt your skin so the sponge is the cheap and best option for this. The sponges are attached to the shaft, so when the shaft rotates with the help of motor when we lie back it will rotate in the posterior back of the body by rubbing your skin. A soap water reservoir is placed on the top of the frame which can be turned ON and OFF manually. The soap water through the hole like structure in reservoir which is connected to the shaft when we turned on the reservoir manually the water slightly flows over the shaft and the sponge starts to absorb the soap water because it can observe the liquid things easily. Now the wet sponge is able to clean the back of the body quite well. The adjustment lever is setted up in the side of the frame through which we can adjust the front and back position it makes us more comfortable. Three rollers are setup in the back and two rollers are placed on the both side and are clamped so the roller can clean the back easily this is the very simple mechanism which can be easily understand by everyone. The motor is covered by a frame which protects it from being wet so it prevents the electric leakage this is the most essential thing in the regular household products. We cannot wash our back easily so this machine is used to wash our back. the soap water is filled manually which can be turned on and off easily this soap water reservoir should correctly flow over only by the shafts which are attached by the rollers and the water should not leak on it's own.

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CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

Muigai, M. N., Esther Titilayo Akinlabi, and F. M. Mwema. (2021) This paper presents the effects of TIG direct current (DC) on the hardness of mild steel samples coated with stainless steel. The coating was undertaken using TIG welding using stainless steel welding rods. The hardness of the coated samples was analyzed using a Digital Rockwell hardness Tester. The hardness test was carried out across the coated samples from the substrate to the coating region. The data obtained when hardness was measured is presented and discussed in this article. The relationship between DC welding current and hardness is also discussed. From the results, the hardness of the coated samples increased from the substrate towards the coating surface. It was also shown that hardness and DC current of the TIG system exhibit an inverse relationship. Welding is extensively used technology for joining of metallic parts . There are various welding techniques which include arc welding, oxy-fuel gas welding, solid-state welding, laser-based welding, resistance welding and so forth. Tungsten Inert Gas (TIG) welding is a type of arc welding technique which uses a non-consumable Tungsten electrode to melt the metallic parts which are to be joined . The TIG welding technique has superior advantages over the other arc welding processes such as Metal Inert Gas (MIG) welding and Plasma arc welding PAW). Such advantages include its ability to weld within shielded conditions and during the process, various parameters can be controlled .[1]

Song, J. L., Z. Q. Liu, (2017) The main topics discussed include the status quo of research on these technologies; the design and calculation of process parameters; the numerical simulation of cold rolling forming processes; and the equipment used. The mechanism of cold rolling forming is extremely complex, and research on the processes, theory and mechanical analysis of spline cold rolling forming has remained very limited to date. In practice, the forming processes and production methods used are mainly chosen on the basis of individual experience. As such, there is a marked lack of both systematic, theory-based guidelines, and of specialized books covering theoretical analysis, numerical simulation, experiments and equipment used in spline cold rolling forming processes. Illustrated using tables, 3D photographs and formula derivations, this book fills that gap in the literature.[2]

Rubel, R. I., M. J. Iqball, and M. E. Hoque. (2017) The CNG driven three-wheeler has become a common form of transport vehicle for hiring or private use. It is being used around the world including many developing countries like Bangladesh. It offers transport facility for people with both lower and higher income. Therefore, properly dimensioned propeller shaft is fundamental to enable smooth and trouble-free service. The major disturbances observed are excessive deflections, fatigue failures or exceeding natural frequencies. But in practice overload or continuous excessive torque loads, road condition, low maintenance, incorrect or improper mounting of shaft causes a high amount of shaft failures among all other parts. Such unpredictable failure causes hazardous journey experience. For this type of vehicles, propeller shaft rotates and transmits power from engine to rear wheels directly in absence of any intermediate differential gear box. Therefore, it is subjected to fluctuating loads of combined bending and torsion with various degrees of stress concentrations over the shaft varying with speed. Hence, failure of its shaft appears to be a common phenomenon. Though significant number of these vehicles are on service through the country, the change of spare parts facility is not only insufficient but also time consuming specially in case of its shaft. It is to be imported from abroad, as a consequence replacement becomes costly. In this work, mechanical properties of locally procured mild steel are developed through hardening process to study the prospect of using it as a drive shaft.[3]

Martin, and Jan Dupal. (2017) The paper is concerned with vibration problem in a spur gearing. A one-degree-of-freedom (1 DOF) linear and periodic system including mesh stiffness and manufacturing error is considered. The parabolic function is used to describe the stiffness of tooth pair in a single pair contact. The approach using the periodic Green's function (PGF) in the form of truncated Fourier series is applied to find an analytical periodic solution in a steady state. Moreover, the method enables to find the borders of (in)stability by means of the real eigenvalues of the so called system matrix. The presented approach enables to solve the problem even in the case when periodic stiffness is implicit function of fluctuation parameter. The stability diagrams are presented and the validation of their correctness is performed by the Floquet method. The dynamic system behaviour in a steady state is also investigated and the periodic solution obtained by the presented analytical method is compared with the results given by the Runge–Kutta continuation. A very good agreements are achieved in all cases. Such studies have shown that the linear models are unable to describe the consequence of some effects (e.g. the gear backlash) occurring during the gear mesh which are not subject of the presented study. Blankenship and Kahraman [6] developed equation to describe physical behaviour observed in rotating machinery which contain time varying system parameters arising from periodically changing contact regimes due to clearances. [4]

Osakue, Edward E., and Lucky Anetor (2016) New perspectives such as harmonic mean, contact patch as translating third body, contact form factor, and service load factor are introduced in spur gear design. The harmonic mean rule characterizes the physical and geometric properties of the contact patch. The contact patch is construed as a body in translation during gear teeth engagement. The contact form factor may be used to compare the load capability of different pressure angle standards. The service load factor captures the influence of different conventional rated load modification factors. Gear design analysis is separated into design sizing and design verification tasks. Design sizing and design verification formulas are formulated and presented in simplified forms for the Hertz contact and the Lewis root bending stresses. Three design Examples are presented through which it is demonstrated that results from the contact and root bending stress capacity models compare very favorably with American Gear Manufacturers Association (AGMA) results.[5]

Kim, Daewon, et al. (2016) A robust superamphiphobic sponge (SA-sponge) is proposed by using a single initiated chemical vapor deposition (i-CVD) process. Poly(3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecyl methacrylate) (PFDMA) is deposited on a commercial sponge by the polymerization of fluoroalkyl acrylates during the i-CVD process. This PFDMA is conformally coated onto both the exterior and interior of the sponge structure by a single step of the i-CVD process at nearly room temperature. Due to the inherent porous structure of the sponge and the hydrophobic property of the fluorine-based PFDMA, the demonstrated SA-sponge shows not only superhydrophobicity but also superoleophobicity. Furthermore, the fabricated SA-sponge is robust with regard to physical and chemical damage. The fabricated SA-sponge can be utilized for multi-purpose applications such as gas-permeable liquid separators.[6]

Zhang, Da-Wei, and Sheng-Dun Zhao. (2014) The research and implementation work for a new shaft part rolling process have been carried out in the present study, where the shaft has a thread and a small module spline or gear. This method is developed based on two-roll cross rolling technologies for thread and spline, and two round rolling dies provide special structure for synchronously forming thread and spline (or gear). In one rolling process, the threaded and splined (or geared) shapes on the different portions of shaft part are formed synchronously, and then the manufacturing cycle has been shortened and the relative phase between thread and spline (or gear) in mass production can be keep stable. [7]

Daudin-Schotte, Maude, (2014) The Cultural Heritage Agency of the Netherlands (RCE) 2006–2009 dry cleaning research project investigated a broad range of dry cleaning materials (latex sponges, make-up sponges, PVC erasers, Factis erasers, Gum powders, microfiber cloths, mouldable materials), each with very variable affinities to dirt and paint surfaces, from efficient and safe cleaning to abrasion and residues hazards. This paper presents a follow-up to the RCE 2006–2009 research, focusing on the long-term effect of potential chemical residues, facilitated by our practical experience acquired in workshops since 2010 together with further scientific analysis.[8]

Randall, Robert B., and Jerome Antoni. (2011) This tutorial is intended to guide the reader in the diagnostic analysis of acceleration signals from rolling element bearings, in particular in the presence of strong masking signals from other machine components such as gears. Rather than being a review of all the current literature on bearing diagnostics, its purpose is to explain the background for a very powerful procedure which is successful in the majority of cases. The latter contention is illustrated by the application to a number of very different case histories, from very low speed to very high speed machines. The specific characteristics of rolling element bearing signals are explained in great detail, in particular the fact that they are not periodic, but stochastic, a fact which allows them to be separated from deterministic signals such as from gears. They can be modelled as cyclostationary for some purposes, but are in fact not strictly cyclostationary (at least for localised defects) so the term pseudo-cyclostationary has been coined. An appendix on cyclostationarity is included. A number of techniques are described for the separation, of which the discrete/random separation (DRS) method is usually most efficient. This sometimes requires the effects of small speed fluctuations to be removed in advance, which can be achieved by order tracking, and so this topic is also amplified in an appendix. Signals from localised faults in bearings are impulsive, at least at the source, so techniques are described to identify the frequency bands in which this impulsivity is most marked, using spectral kurtosis.[9]

Khabou, M. T., et al. (2011) In this paper the dynamic behavior of a single stage spur gear reducer in transient regime is studied. Dynamic response of the single stage spur gear reducer is investigated at different rotating velocities. First, gear excitation is induced by the motor torque and load variation in addition to the fluctuation of meshing stiffness due to the variation of input rotational speed. Then, the dynamic response is computed using the Newmark method. After that, a parameter study is made on spur gear powered in the first place by an electric motor and in the second place by four strokes four cylinders diesel engine. Dynamic responses come to confirm a significant influence of the transient regime on the dynamic behavior of a gear set, particularly in the case of engine acyclism condition. The external sources of excitation are mainly induced by the fluctuation of the input velocity and torque caused by the motor at its transient regime. The load condition variation can also be considered a significant external source of excitation. But, it seems that the effects of input rotational velocity on the linear dynamic behavior of gears were investigated only on few occasions. This paper is made of four sections. Introduction is set in Section 1. Section 2 focuses mainly on the external source of the gear set excitation. Actually, it studies the influence of both rotational speed variation and the fluctuations of an electric motor torque on the dynamic behavior of a single stage geared system. [10]

Fernandez del Rincon, Alfonso, et al. (2010) Gear transmissions in general and spur gears in particular exhibit a different dynamic behavior depending on the level of the transmitted load. This fact justifies the interest in the study of the role of the load in gear dynamics not only in the context of design, vibration and noise control but also for condition monitoring. This task requires the development of advanced models achieving a compromise between accuracy and computation time. In this work, gear and bearing non-linearities associated with the contact among teeth and roller elements have been included, taking into account the flexibility of gears, shafts and bearings. Besides, parametric excitations coming both from gear and bearing supports, as well as clearance, were also considered. Gear contact force calculations are carried out following a hybrid approach which combines both analytical and numerical tools. This lets to achieve accurate results with an acceptable computational effort and thus dynamic analysis becomes feasible. This approach was improved and the calculation speeded up from the point of view of computational time. This was performed by using a pre-calculated value for gear tooth stiffness as a function of load and the angular position when it operates under stationary conditions. On the other hand, bearings were formulated just as deflections of Hertzian type. This means that bending and shearing of races and rolling elements are neglected. However, the variation in the number of loaded rolling elements as a function of the load and the angular position was taken into account. [11]

Harris, Tedric A. (2006) For the last four decades, Tedric Harris' Rolling Bearing Analysis has been the "bible" for engineers involved in rolling bearing technology. Why do so many students and practicing engineers rely on this book? The answer is simple: because of its complete coverage from low to high speed applications and full derivations of the underlying mathematic In most bearing applications, only applied radial, axial, or combined radial and axial loadings are considered. However, under very heavy applied loading or if shafting is hollow to minimize weight, the shaft on which the bearing is mounted may bend, causing a significant moment load on the bearing. Dynamic (inertial) loading occurs between rolling elements and bearing raceways because of rolling element orbital speeds and speeds about their own axes. At slow-to-moderate operat-ing speeds, these dynamic loads are very small compared with the ball or roller loads caused by the loading applied to the bearing. At high operating speeds, however, these rolling element dynamic loads, centrifugal forces, and gyroscopic moments will alter the distribution of the applied loading among the balls or rollers.[12]

Hansen, J. Brinch. (1970) TERZAHI'S notations are to be applied to the simple formula for the bearing capacity of a shallow foundation developed by buisman, caquot and terzaghi. the exact formulas for the bearing capacity indicated by prandtl are presented. however, actual foundations deviate in several respects from the simple case. apart from the eccentricity which is best taken into account by considering the so-called effective foundation area, all the other influences can be expressed by means of suitable factors to the three terms in the original formula. examples are given for extending the formula to calculate: effective foundation area, load inclination factors, and base and ground inclination. experimental evidence must be used for the shape factors, depth effects and depth factors. general formulas are presented with modifications for calculating passive earth pressure and modifying for specific soil parameters and safety factors.[13]

Bisson, Edmond E., and William J. Anderson. (1964) One of the significant advancements in bearing technology is the development of ceramic bearings. Ceramic materials, such as silicon nitride or zirconia, offer superior strength, corrosion resistance, and temperature stability compared to traditional steel bearings. It's similar to the wheel, the bearing enables the device to roll, which reduces the friction between the bearing surface and its tumbling surface. When friction is reduced, it is very easy to move in a rotational or linear fashion which also increases speed and efficiency. High temperature bearings use specialized lubricants to stand up to intense heat. Grease-packed bearings are pre-filled with fluorine grease for high temperatures, while YS and SJ bearings use molybdenum disulfide (MoS_2) solid lubricant to withstand temperatures up to 350°C and 400°C respectively.14]

Meyerhof, George Geoffrey. (1963) The first part of the paper summarizes the results of recent research on the bearing capacity of spread foundations of various shapes under a central vertical load and outlines the effects of foundation depth, eccentricity and inclination of the load. Simple formulae have been derived for use in practice and their application to the design of rigid and flexible foundations is briefly indicated.The second part of the paper discusses the bearing capacity of single piles under vertical and inclined loads. The bearing capacity of piled foundations and free-standing pile groups is outlined, and the results of model tests on pile groups under central and eccentric loads are briefly analysed in relation to some problems in practice. Simple formulae have been derived for use in practice and their application to the design of rigid and flexible foundations is briefly indicated.The second part of the paper discusses the bearing capacity of single piles under vertical and inclined loads. The bearing capacity of piled foundations and free-standing pile groups is outlined, and the results of model tests on pile groups under central and eccentric loads are briefly analysed in relation to some problems in practice.[15]

2.2.LITERATURE SUMMARY

- Investigate the dynamic behavior of a single-stage spur gear reducer in transient regime, considering factors like motor torque, load variation, and meshing stiffness fluctuations due to input rotational speed changes.
- Introduce new perspectives in spur gear design, including harmonic mean, contact patch characterization, contact form factor for comparing load capability, and service load factor for evaluating conventional rated load modification factors.
- Address vibration problems in spur gearing using a one-degree-of-freedom linear and periodic system model, incorporating mesh stiffness and manufacturing error. They utilize the periodic Green's function to find analytical periodic solutions and stability diagrams.
- Study the dynamic behavior of gear transmissions, considering load variations and non-linearities associated with gear and bearing contacts. They employ a hybrid approach combining analytical and numerical tools for accurate dynamic analysis.

- Investigate failures in CNG-driven three-wheeler vehicles, particularly related to propeller shafts, and propose using locally processed mild steel to enhance shaft durability.
- Explore the effects of TIG welding on the hardness of mild steel samples coated with stainless steel, discussing the relationship between welding current and hardness.
- Discuss advancements in bearing technology, particularly the development of ceramic bearings, highlighting their superior properties compared to traditional steel bearings.
- Provide comprehensive coverage of rolling bearing analysis, discussing factors affecting bearing loading, dynamic loads, and operating speeds.
- Summarize research on the bearing capacity of spread foundations and single piles under various loads, providing formulas for practical design applications.
- Offer a tutorial on diagnostic analysis of acceleration signals from rolling element bearings, focusing on signal characteristics and separation techniques.
- Discuss formulas for calculating the bearing capacity of shallow foundations under various conditions, considering factors like load inclination and soil parameters.
- Introduce a robust superamphiphobic sponge fabricated using a single initiated chemical vapor deposition process, suitable for various applications requiring superhydrophobicity and superoleophobicity.
- Present research on the long-term effects of potential chemical residues from dry cleaning materials, emphasizing practical experience and scientific analysis.
- Review research on cold rolling forming processes, particularly spline cold rolling forming, addressing design, calculation, simulation, and equipment used.
- Describe a new shaft part rolling process involving thread and spline or gear formation using two-roll cross rolling technologies, aiming to shorten manufacturing cycles and maintain stable relative phases in mass production.

CHAPTER – 3

METHODOLOGY

3.1 FLOWCHART

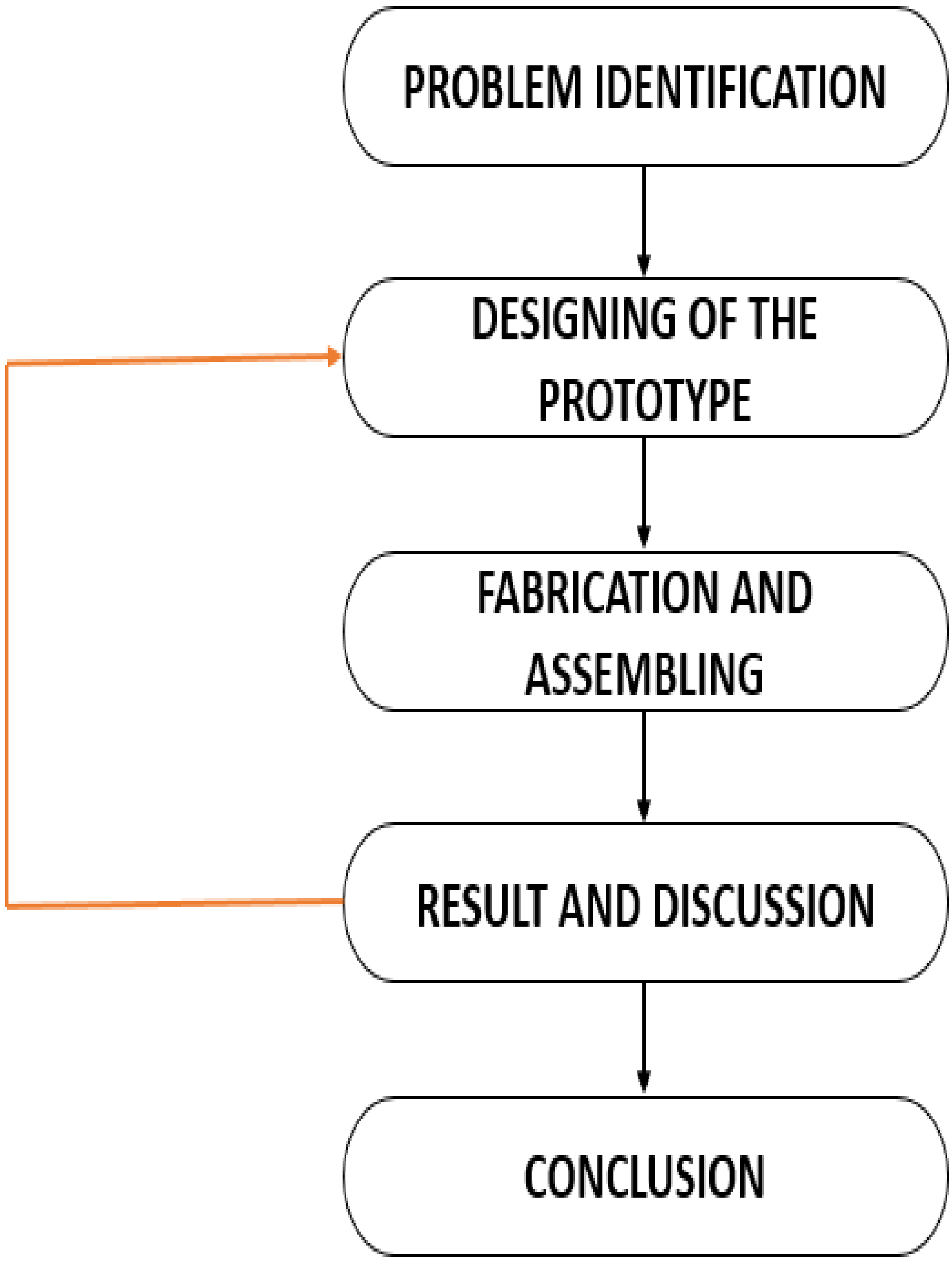

FIGURE 3.1 - METHODOLOGY

3.2 PROBLEM IDENTIFICATION

- It is difficult for us to wash the Posterior back of our body while bathing. Although we are using some back scrubber belt for washing our back it's a quite difficult one.
- Alternatively buying a scrubber should be placed in wall and we should rub our back manually and it also require a individual space for setup.

3.3OBJECTIVE

- It is difficult wash our posterior back by our self, by using only our hands we cannot wash it easily.
- So we are making a machine which is attached to the toilet which do not need an individual space for setup.
- A certain number of rollers are connected and being rotated by a motor and it will start to rotate.

3.4 DETAILED ENGINEERING

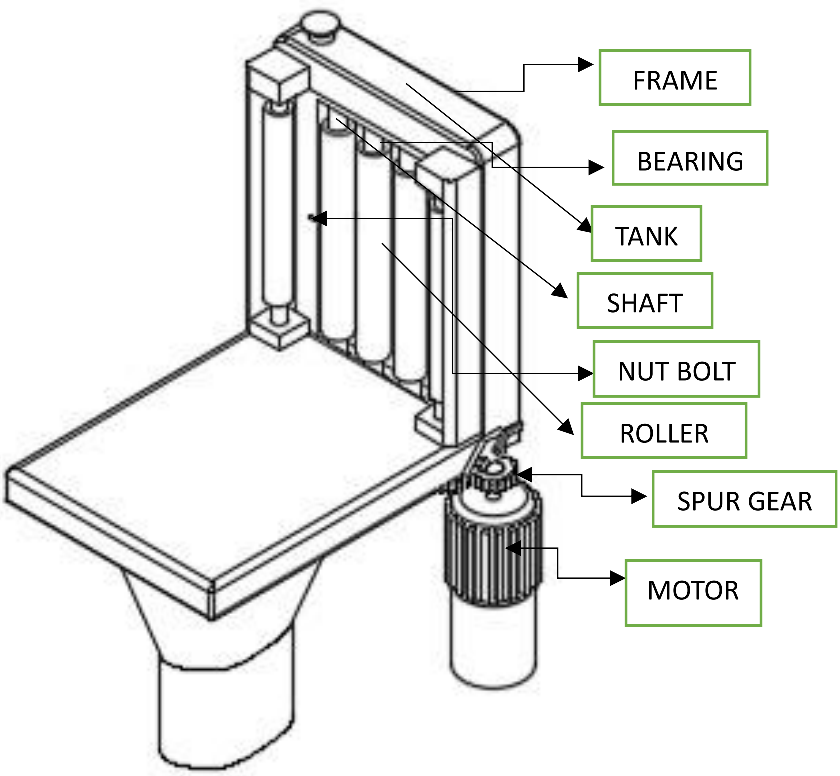

FIGURE 3.2 – HUMAN BACK WASHER

3.5.COMPONENTS

- Gear
- Shaft
- Motor
- Bearing
- Frame
- Water tank
- Screw and Nut
- Sponge

3.5.1. Spur Gear

Spur gears are essential components in mechanical power transmission systems, serving as the backbone of countless industrial and automotive applications. These gears feature teeth that project radially from the gear's circumference and mesh with teeth on adjacent gears, transmitting torque and rotational motion between parallel shafts. Their simple yet effective design facilitates efficient speed reduction or increase, depending on the gear ratio, making them indispensable in machinery where precise control over rotational speed is paramount. One of the key advantages of spur gears lies in their straightforward manufacturing process, which contributes to their widespread use across industries. Machining techniques, such as hobbing and shaping, enable the production of spur gears with high precision and consistency.

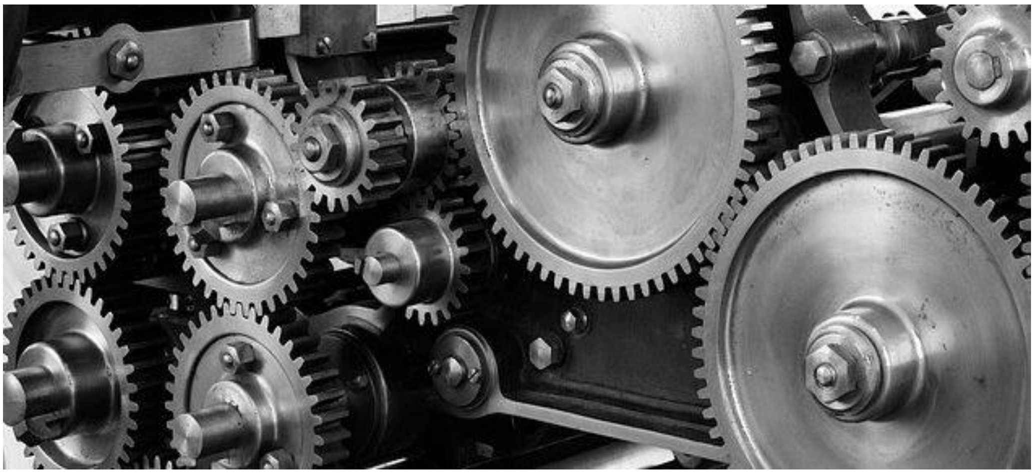

FIGURE 3.3 – SPUR GEAR

However, despite their simplicity, spur gears are not without challenges. Dynamic behavior and performance can be influenced by factors such as gear tooth profile, meshing stiffness, and load variations. Engineers and researchers continually strive to optimize spur gear design to improve efficiency, reduce noise, and enhance reliability. Advanced computational tools and simulation techniques aid in this optimization process, allowing for thorough analysis of gear performance under various operating conditions. Furthermore, advancements in materials science have led to the development of high-strength, wear-resistant materials for spur gear applications, prolonging their service life and reducing maintenance requirements. Additionally, innovations in surface treatment technologies, such as carburizing and nitriding, improve the wear resistance and durability of gear teeth, ensuring smooth and reliable operation even in demanding environments. In conclusion, spur gears represent a cornerstone of mechanical engineering, providing efficient and reliable power transmission in a wide range of applications. Continued research and innovation in spur gear design, manufacturing, and materials will further enhance their performance and longevity, ensuring their continued importance in the modern industrial landscape.

3.5.2.Shaft

Shafts are vital components in virtually every machine, serving as the backbone of power transmission systems and providing support for rotating elements such as gears, pulleys, and sprockets. These cylindrical rods transmit torque from one rotating part to another, enabling the conversion of rotational motion into useful work across a myriad of industrial, automotive, and aerospace applications.One of the primary functions of shafts is to transfer rotational motion from a power source, such as an electric motor or engine, to various mechanical components within a machine.

This transfer of power is accomplished through a combination of key elements, including coupling mechanisms, bearings, and support structures, all carefully designed to minimize energy losses and ensure efficient operation. Shafts come in a variety of shapes, sizes, and materials, each tailored to specific application requirements. Common materials include steel, stainless steel, and aluminum alloys, chosen for their strength, durability, and resistance to fatigue and corrosion. Moreover, advancements in materials science have led to the development of specialized alloys and composite materials with superior mechanical properties, further expanding the range of applications for shafts in modern machinery.

In addition to transmitting power, shafts also play a critical role in maintaining the alignment and stability of rotating components within a machine. Proper shaft alignment is essential for minimizing wear and vibration, which can lead to premature failure and reduced efficiency. Bearings, mounted along the length of the shaft, provide support and reduce friction between the rotating shaft and stationary components, ensuring smooth operation and extended service life.

FIGURE 3.4 – SHAFT

Furthermore, shafts often undergo various manufacturing processes, including machining, forging, and heat treatment, to achieve precise dimensions, surface finishes, and mechanical properties. Advanced machining techniques, such as computer numerical control (CNC) machining and precision grinding, enable the production of shafts with tight tolerances and complex geometries, meeting the exacting demands of modern machinery.

In conclusion, shafts are indispensable components in machines of all types, providing the means for transmitting power, maintaining alignment, and supporting rotating elements. Continued advancements in materials, manufacturing techniques, and design methodologies will further enhance the performance, reliability, and efficiency of shafts in the ever-evolving landscape of industrial and technological innovation.

3.5.3. Bearing

Bearings are integral components in machinery, facilitating smooth and efficient rotation by reducing friction and supporting loads. Found in virtually every mechanical system, bearings enable the movement of rotating shafts or axles while minimizing energy loss and wear. These crucial components come in various forms, including ball bearings, roller bearings, and plain bearings, each designed to suit specific application requirements. One of the primary functions of bearings is to support rotating shafts or axles within a machine. By providing a low-friction interface between moving parts, bearings enable smooth rotation while minimizing heat generation and wear. This friction reduction not only improves efficiency but also extends the service life of machinery, reducing maintenance costs and downtime. Bearings also play a critical role in maintaining alignment and stability within a machine.

FIGURE 3.5 - BEARING

Additionally, bearings help to distribute loads evenly across rotating elements, preventing excessive stress and fatigue that can lead to component failure. The design of bearings varies depending on the specific application and operating conditions. Ball bearings, for example, utilize small balls housed within a raceway to reduce friction and support axial and radial loads. Roller bearings, on the other hand, employ cylindrical or tapered rollers to distribute loads more evenly and accommodate higher loads and speeds. Plain bearings, also known as bushings or sleeve bearings, rely on a sliding interface between two surfaces to support rotating shafts with minimal friction. Advancements in bearing technology continue to drive improvements in performance, reliability, and efficiency. Innovations such as ceramic bearings, hybrid bearings, and self-lubricating bearings offer enhanced durability, reduced friction, and extended service intervals, making them ideal for demanding applications in industries such as aerospace, automotive, and industrial manufacturing.

In conclusion, bearings are indispensable components in machinery, enabling smooth and efficient rotation while minimizing friction and wear. Their role in supporting loads, maintaining alignment, and improving overall system performance makes them essential for the reliable operation of countless mechanical systems across various industries. Continued advancements in bearing technology will further enhance their capabilities, driving innovation and efficiency in the ever-evolving field of mechanical engineering.

3.5.4.Motor

Motors are the powerhouse of machinery, converting electrical energy into mechanical work across a vast array of applications in industries ranging from manufacturing to transportation. These electromechanical devices come in various types, including electric motors, combustion engines, and hydraulic motors, each tailored to specific tasks and operating conditions. Electric motors are among the most common types, prized for their efficiency, reliability, and versatility. Found in everything from household appliances to industrial machinery, electric motors utilize electromagnetic principles to produce rotational motion.

They consist of a stator, which generates a rotating magnetic field, and a rotor, which interacts with this field to produce torque and rotation. Electric motors offer precise control over speed and torque, making them ideal for applications requiring variable speed operation. Combustion engines, on the other hand, rely on the combustion of fuel to generate mechanical power. Internal combustion engines, such as gasoline and diesel engines, combust fuel within a confined space to produce high-pressure gases that drive pistons, crankshafts, and ultimately, mechanical motion. These engines are widely used in automotive vehicles, power generators, and heavy machinery, where high power output and portability are essential. Hydraulic motors operate by utilizing the pressure of hydraulic fluid to generate mechanical power. These motors convert hydraulic energy into rotational motion through the action of pistons, vanes, or gears, making them suitable for applications where high torque and low speed are required. Hydraulic motors are commonly found in construction equipment, agricultural machinery, and marine propulsion systems, offering robust performance and excellent reliability in demanding environments. Regardless of type, motors play a critical role in driving productivity, efficiency, and innovation across industries.

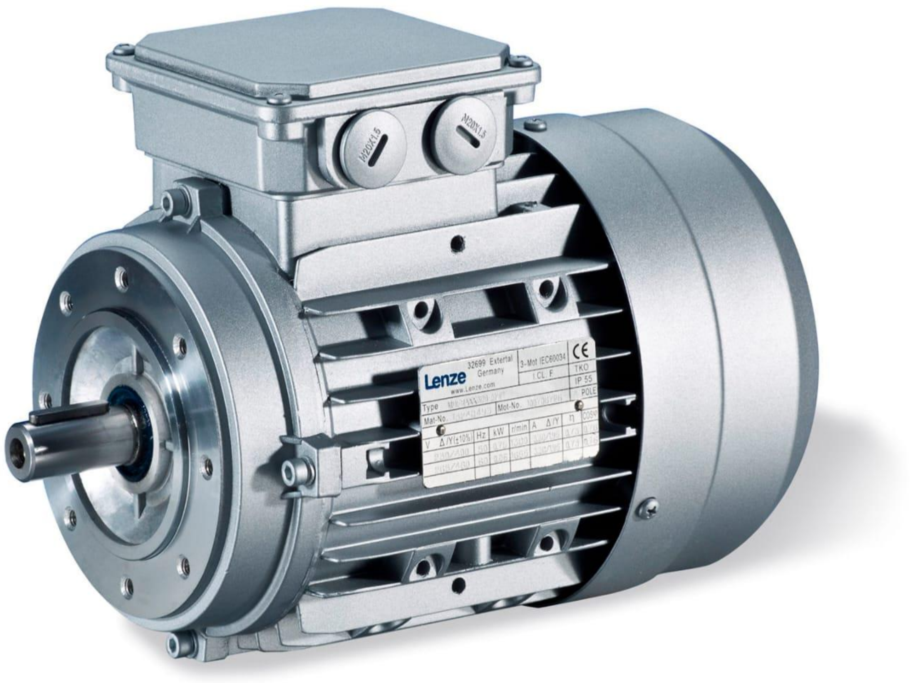

FIGURE 3.6 – MOTOR

They power conveyor belts in manufacturing plants, propel vehicles on roads and railways, and drive pumps and compressors in industrial processes. Advances in motor technology, such as brushless DC motors, variable frequency drives, and regenerative braking systems, continue to improve efficiency, reduce emissions, and enhance performance in both traditional and emerging applications. In conclusion, motors serve as the workhorses of modern machinery, providing the mechanical power necessary to drive industrial processes, transport goods and people, and perform countless other tasks essential to daily life. Their diverse range of types and applications underscore their importance in powering the world's economy and driving technological progress. Continued advancements in motor technology will further improve efficiency, reliability, and sustainability, ensuring motors remain at the forefront of innovation in the years to come.

3.5.5.Frame

Frames form the structural backbone of machinery, providing support, rigidity, and stability to various components and systems. Acting as the framework upon which other machine elements are mounted, frames play a critical role in maintaining alignment, minimizing vibration, and ensuring overall functionality and performance.One of the primary functions of frames is to support and enclose the internal components of a machine, providing a stable platform for assembly and operation. Frames are typically constructed from sturdy materials such as steel, aluminum, or composite materials, chosen for their strength, durability, and resistance to deformation under load. Additionally, frames are often designed to withstand dynamic forces and environmental factors encountered during operation, such as shock, vibration, and temperature fluctuations.In addition to providing structural support, frames also serve as the housing for various machine elements, including motors, actuators, and control systems. These components are securely mounted to the frame, ensuring proper alignment and minimizing the risk of misalignment or damage during operation. Frames may also incorporate features such as mounting brackets, cable routing channels, and access panels to facilitate installation, maintenance, and troubleshooting.

FIGURE 3.7 – FRAME

Furthermore, frames are designed to optimize the overall performance and efficiency of machinery by minimizing weight, reducing energy consumption, and enhancing ergonomics. Advanced manufacturing techniques, such as computer-aided design (CAD) and finite element analysis (FEA), enable engineers to optimize frame designs for specific applications, balancing factors such as strength, weight, and cost.

Frames come in various configurations and designs, ranging from simple welded structures to complex, multi-component assemblies. The choice of frame design depends on factors such as load requirements, space constraints, and operational considerations. For example, machines operating in harsh environments may require heavy-duty frames with reinforced bracing and protective coatings, while machines in cleanroom environments may require lightweight, corrosion-resistant frames constructed from materials such as stainless steel or aluminum.

In conclusion, frames are essential components in machinery, providing the structural support and enclosure necessary for the reliable operation of internal components and systems. Their design, construction, and integration play a crucial role in optimizing performance, enhancing durability, and ensuring safety across a wide range of industrial and commercial applications. Continued advancements in frame technology will further improve efficiency, reliability, and sustainability in the design and operation of machinery in the years to come.

3.5.6.Screw And Nut

Screws and nuts form a fundamental pairing in machinery, providing a versatile means of fastening, securing, and adjusting components within mechanical systems. The threaded interaction between a screw and nut allows for the conversion of rotational motion into linear motion, making them indispensable in a wide range of applications across industries. At its core, the function of screws and nuts in machines is fastening and assembly. By rotating a screw into a threaded nut, a clamping force is created between mating surfaces, securely holding components together. This simple yet effective fastening mechanism allows for easy installation, disassembly, and adjustment, making screws and nuts ideal for applications requiring versatility and flexibility. Beyond fastening, screws and nuts are often employed for mechanical advantage in machines.

By incorporating a threaded screw and nut arrangement, mechanical advantage is achieved, allowing for the exertion of large forces with relatively small input torque. This principle is utilized in devices such as screw jacks, where rotational motion applied to the screw is converted into linear motion to lift heavy loads. Moreover, screws and nuts play a crucial role in motion control and positioning within machinery. Lead screws, for example, feature a threaded shaft and nut that translate rotational motion into linear motion. This linear motion is used in precision applications such as CNC machines, 3D printers, and robotic systems for accurate positioning of tooling or workpieces. The pitch of the screw thread determines the resolution and speed of the linear motion, allowing for precise control over movement.

FIGURE 3.8 – SCREW AND NUT

Furthermore, screws and nuts are essential components in mechanisms such as gears, pulleys, and cams, where they transmit rotational motion between shafts or convert rotary motion into linear motion. By combining screw and nut arrangements with other mechanical elements, complex motion control systems can be created, enabling a wide range of functions such as indexing, feeding, and actuation in machinery.

In conclusion, screws and nuts are versatile and indispensable components in machines, providing a reliable and efficient means of fastening, mechanical advantage, motion control, and positioning. Their simple yet effective design makes them suitable for a myriad of applications across industries, from automotive and aerospace to manufacturing and construction. As technology continues to evolve, screws and nuts will remain essential components driving innovation and efficiency in machinery and mechanical systems.

3.5.7.Sponges

Sponges are essential tools for cleaning tasks in both household and industrial settings, offering versatility, efficiency, and effectiveness in removing dirt, grime, and stains from various surfaces. These porous, absorbent materials are available in a wide range of sizes, shapes, and compositions, each tailored to specific cleaning needs and preferences. In household cleaning, sponges are utilized for a multitude of tasks, from washing dishes and wiping countertops to scrubbing floors and surfaces. Their soft yet abrasive texture makes them suitable for gentle cleaning of delicate surfaces like glass and ceramics, while their durability allows for more vigorous scrubbing of tougher stains on surfaces like tile and metal. Additionally, sponges are often paired with cleaning solutions to enhance their effectiveness, whether removing grease from cookware or soap scum from bathroom fixtures.

In industrial and commercial settings, sponges play a vital role in maintaining cleanliness and hygiene standards. They are used in industries such as food service, hospitality, and healthcare for tasks such as sanitizing surfaces, cleaning equipment, and wiping down workspaces. Disposable sponges are often preferred in these environments to minimize cross-contamination and ensure hygiene compliance, while reusable sponges with antimicrobial properties offer durability and long-lasting performance.

FIGURE 3.9 – SPONGE

Moreover, sponges are valued for their ability to absorb and hold liquids, making them efficient tools for spill cleanup and moisture removal. Whether absorbing water from floors or soaking up spills in laboratories and workshops, sponges provide a quick and effective solution for managing liquid messes. Their absorbent nature also makes them useful for applying cleaning solutions or disinfectants to surfaces, ensuring thorough coverage and effective cleaning. Furthermore, advancements in sponge technology have led to the development of specialized cleaning sponges designed for specific tasks and surfaces. Microfiber sponges, for example, feature ultra-fine fibers that trap and remove dirt and dust without the need for harsh chemicals, making them ideal for sensitive surfaces and allergy-prone individuals. Similarly, abrasive sponges with scouring pads or scrubbing surfaces offer increased cleaning power for tackling tough stains and baked-on residue.

In conclusion, sponges are versatile and indispensable tools for cleaning tasks in both household and commercial settings, offering efficiency, effectiveness, and convenience. Whether used for washing dishes, wiping surfaces, or absorbing spills, their absorbent and abrasive properties make them invaluable for maintaining cleanliness and hygiene standards. As technology continues to evolve, so too will the capabilities and applications of sponges, ensuring their continued relevance in the field of cleaning and sanitation.

3.5.8.Water Tank

Water storage tanks are critical components of various machines and systems, serving as reservoirs for storing and distributing water for a multitude of purposes. These tanks come in various shapes, sizes, and materials, each tailored to specific application requirements and environmental conditions. In industrial and commercial machinery, water storage tanks play a vital role in processes such as cooling, heating, and mixing. For example, in HVAC (Heating, Ventilation, and Air Conditioning) systems, water tanks are used to store chilled or heated water, which is then circulated through coils or pipes to regulate the temperature of air in buildings. Similarly, in manufacturing processes, water tanks are utilized for mixing chemicals, diluting solutions, and providing water for various production operations. In agricultural machinery and equipment, water storage tanks are essential for irrigation, livestock watering, and crop spraying. Large-capacity tanks are often used to collect and store rainwater or well water, which is then distributed through irrigation systems to fields or pastures. Additionally, portable water tanks mounted on trucks or trailers enable farmers to transport water to remote areas or areas without access to traditional water sources. Furthermore, in residential and commercial buildings, water storage tanks are integral components of plumbing systems, providing a reliable supply of potable water for drinking, cooking, bathing, and sanitation. These tanks may be located above ground or underground and are typically made of materials such as steel, concrete, fiberglass, or plastic. In areas with unreliable water supplies or frequent power outages, water storage tanks equipped with backup pumps or gravity-fed systems ensure continuous access to clean water for residents and occupants.

Moreover, water storage tanks are essential for emergency preparedness and disaster response efforts. In regions prone to natural disasters such as hurricanes, floods, or droughts, water tanks serve as emergency water reserves, providing essential supplies for drinking, firefighting, and sanitation when traditional water sources are compromised or unavailable. Portable water tanks and water trailers are often deployed by emergency response teams to provide immediate relief to affected communities in disaster-stricken areas.

In conclusion, water storage tanks are versatile and indispensable components of machines and systems across various industries and applications. Whether used for industrial processes, agricultural irrigation, residential plumbing, or emergency preparedness, these tanks play a crucial role in ensuring access to clean and reliable water supplies for a wide range of purposes. As technology continues to advance, so too will the design, construction, and functionality of water storage tanks, further enhancing their efficiency, durability, and versatility in the years to come.

3.6.FABRICATION PROCESS

FIGURE 3.10 – GEAR ARRANGEMENT

An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the hollow rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates.

FIGURE 3.11 CUTTING

The sponge is added to the connected shaft because the sponge is the soft material so it will not harm our skin because the other materials like scrubber when forcefully rubbed into the skin it will hurt your skin so the sponge is the cheap and best option for this. The sponges are attached to the shaft, so when the shaft rotates with the help of motor when we lie back it will rotate in the posterior back of the body by rubbing your skin.

FIGURE 3.12 - GRINDING

The soap water through the hole like structure in reservoir which is connected to the shaft when we turned on the reservoir manually the water slightly flows over the shaft and the sponge starts to absorb the soap water because it can observe the liquid things easily. Now the wet sponge is able to clean the back of the body quite well. The adjustment lever is setted up in the side of the frame through which we can adjust the front and back position it makes us more comfortable. Three rollers are setup in the back and two rollers are placed on the both side and are clamped so the roller can clean the back easily this is the very simple mechanism which can be easily understand by everyone. The motor is covered by a frame which protects it from being wet so it prevents the electric leakage this is the most essential thing in the regular household products.

FIGURE 3.13 – GEAR CUTTING

We cannot wash our back easily so this machine is used to wash our back. the soap water is filled manually which can be turned on and off easily this soap water reservoir should correctly flow over only by the shafts which are attached by the rollers and the water should not leak on it's own. when the motor starts to rotate the gear which is at the tip of the motor and the other gears which are meshed with the first gear also rotates with the motor once all the gear starts to rotate the shafts connected to it also start to rotate the sponge a soft material is attached to the shaft also rotates because it is the soft material which don't do any harness or hurt to our body because of it soft nature. And the water reservoir is at the top of the frame the water reservoir can be turned on and off manually the water should only flow through the shafts which are connected with the sponge and all the shaft are clamped to it very tightly because it should not fall or departed while rotating so they are clamped tight.

FIGURE 3.14 LATHE OPERATION

And a adjustment lever is place on the side of the frame which allows us to move both front and back which enables the comfort to the users. This is the overall working process for this design.

CHAPTER – 4

DESIGN CALCULATION

4.1.1.FRAME

Area of frame = l*b sq.units
=420*500
=210000 mm^2

4.1.2.DESIGN OF BEARING

D=25mm

P=100*9.81

Years=365*5 Years
Hours=2 using per day

P=981 W

N=79 RPM

L=3650 hrs

$\frac{c}{p}$ =2.88

$\frac{c}{981}$=2.88

C=2.88*981

C=2825.28N = 288kg_f

D=26mm

C=288 kg_f

Skf=6000

4.1.3. DESIGN OF GEAR

N = 80 rpm

I = 1

P = 373W

$\alpha = 20^0$

STEP 1:

C – 45 Steel (from D.B pgno 8.5)

$\sigma_b = 3200$ kgf/cm^2

$\sigma_c = 9500$ kgf/cm^2

wheel= $[\sigma_b] = 1400$ kgf/cm^2

$[\sigma_c] = 5000$ kgf/cm^2

Step 2:

$$a \geq (i+1)\sqrt[3]{\left(\frac{0.74}{\sigma c}\right)^2 * \left(\frac{E[Mt]}{i\psi}\right)}$$

i=1

$[\sigma_c] = 5000$ kgf/cm^2

$E_{eq} = \frac{2E1E2}{E1+E2}$

E1= E2 = $2.15*10^6$kgf/cm^2

$\Psi = 0.3$ (from D.B pgno 8.14)

$[Mt] = Mt.K_2k$

Mt = 97420 kw/n

$= 97420\,\frac{0.373}{80}$

Mt = 454.2 kgf/cm

Kgf = 1.2

Mt = 545.2*1.2

= 544.8 kgf/cm

$$a \geq (1+1)\sqrt[3]{\left(\frac{0.74}{5000}\right)^2 * \frac{2.15*10^6*544.8}{1*3}}$$

a $\geq$ 8.81 cm

STEP 3: TO FIND MODULE

$$M \geq 1.26 \sqrt[3]{\frac{[Mt]}{y[\sigma b]\Psi z1}}$$

$\Psi_m = 10$

$Z_1 = 36$

Mt = 544.8 kgfcm

Y = 0.3

$$m \geq 1.2 \sqrt[3]{\frac{544.8}{0.3*1400*10*36}}$$

m $\geq$ 0.183 cm $\geq$ 1.83 cm =2mm (Standard value from D.B pgno 8.2)

STEP 4: CONNECTED CENTER DISTANCE

$$a = m\frac{z1+z2}{2}$$

$Z_2/Z_1 = 1$

$Z_2 = 1*Z_1$

$Z_2 = 1*36$

$Z_2 = 36$

For m = 0.2 cm

$$a = 0.4\,\frac{36+36}{2}$$

a = 14.4 cm > $[a]_{min}$

[a]= 14.4 cm > a_{min} = 8.81cm

Calculated center distance [a] is higher than minimum a value.

4.2 DETAILED ENGINEERING

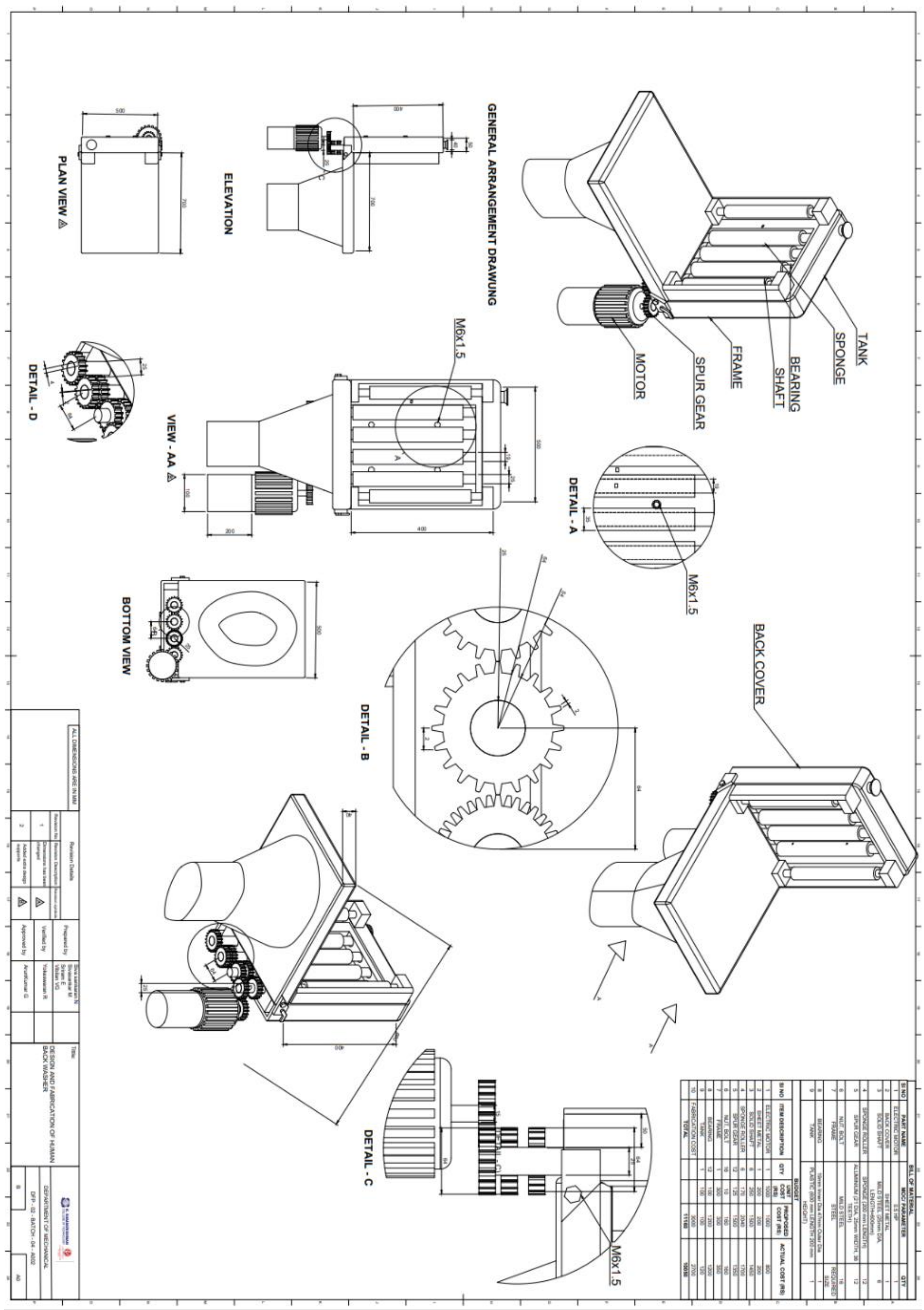

FIGURE 4.1 A0 DRAWING

CHAPTER 5

BILL OF MATERIALS

SI NO	ITEM DESCRIPTION	QUANTITY	UNIT COST (RS)	PROPOSED COST (RS)	ACTUAL COST (RS)
1	ELECTRIC MOTOR	**1**	**1000**	**1000**	**800**
2	SHEET METAL	**1**	**200**	**200**	**200**
3	SOLID SHAFT	**6**	**250**	**1500**	**1450**
4	SPONGE ROLLER	**12**	**170**	**2040**	**1700**
5	SPUR GEAR	**12**	**125**	**1500**	**1350**
6	NUT, BOLT	**16**	**10**	**160**	**160**
7	FRAME	**1**	**300**	**300**	**350**
8	BEARING	**12**	**100**	**1200**	**1200**
9	TANK	**1**	**100**	**100**	**120**
10	FABRICATION COST			**3000**	**2700**
11	**TOTAL**			**11160**	**10050**

TABLE 5.1 COST ESTIMATION

CHAPTER 6
CONCLUSION

It is difficult for us to wash the Posterior back of our body while bathing. Although we are using some back scrubber belt for washing our back it's a quite difficult one. Alternatively buying a scrubber should be placed in wall and we should rub our back manually and it also require a individual space for setup. So we are making a machine which is attached to the toilet which do not need an individual space for setup. A certain number of rollers are connected and being rotated by a motor and it will start to rotate. An Electric motor is set up as the basic power source for this design. When we ON the motor it starts to rotate a gear is fitted at the motor because by only sing the gear the power is transmitted towards all the setup. As you seen in the figure the gears are meshed with each other throughout the setup when the first gear starts to rotate the other gears are also start to rotate and the hollow rods are attached to the gear these rods are setted up in the frame in a linear position as the gear rotates the shaft also rotates. The sponge is added to the connected shaft because the sponge is the soft material so it will not harm our skin because the other materials like scrubber when forcefully rubbed into the skin it will hurt your skin so the sponge is the cheap and best option for this. The sponges are attached to the shaft, so when the shaft rotates with the help of motor when we lie back it will rotate in the posterior back of the body by rubbing your skin. A soap water reservoir is placed on the top of the frame which can be turned ON and OFF manually.

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6.2PHOTOGRAPHY

FIGURE 6.1

6.3 PATTERN DOCUMENT

<table>
<tr><td colspan="2" align="center">FORM5
THE PATENTSACT,1970
(39 of1970)
&
The PatentRules,2003
DECLARATIONASTOINVENTORSHIP
[Seesection10(6)andrule13(6)]</td></tr>
<tr><td>1.NAMEOF APPLICANT(S)</td><td>1. K.RAMAKRISHNANCOLLEGEOF TECHNOLOGY,
an Educational Institution, of the address Kariyamanickam Road, Samayapuram, Trichy, Tamil Nadu, India- 621112;</td></tr>
<tr><td colspan="2">hereby declare that the true and first inventor(s) of the invention disclosed in the Complete specificationfiledinpursuanceofmy/ourapplicationtitled “HUMAN BACK WASHER MACHINE”.</td></tr>
<tr><td colspan="2">1(a). INVENTOR(S)
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Datedthis…..dayof 2024

Signature………………………
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Datedthis…..dayof 2024

Signature………………………
Nameofthesignatory…………………………….

Dated this26th Day of April 2024

A. Albert

Albert Francis

RegisteredPatentAgent

(INPA– 4655)

To
The Controller of Patents,The
Patent Office,
AtChennai