Design and Development of Gear Mechanism for Make in India Logo

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Abstract: Make in India logo epitomizes India's industrial renaissance, blending tradition with innovation. Featuring a dynamic lion emblem alongside gears and cogs, it symbolizes strength, progress, and the fusion of traditional craftsmanship with modern manufacturing. As a beacon of self-reliance and global competitiveness, the logo has played a pivotal role in attracting investment and signalling India's commitment to industrial growth. Its significance extends beyond visual representation, encapsulating India's journey towards economic prosperity and global leadership in manufacturing.

I.INTRODUCTION

Gear mechanisms stand as indispensable components of mechanical systems, facilitating the transmission of motion and power with remarkable precision and efficiency. This abstract delves into the fundamentals, applications, and significance of gear mechanisms in various fields of engineering. At its core, a gear mechanism comprises interlocking toothed wheels, meticulously designed to transfer rotational motion from one shaft to another. This simple yet ingenious concept enables gear systems to amplify torque, regulate speed, and alter direction, thereby serving as the backbone of countless machines and mechanisms. From the intricate gear trains of timepieces to the robust gearboxes of automobiles, gear mechanisms find widespread application across diverse industries. Their versatility extends to industrial machinery, aerospace technology, robotics, and beyond, underpinning the functionality of everything from conveyor belts to space exploration vehicles.

Moreover, the evolution of gear technology continues to push the boundaries of innovation, with advancements in materials, manufacturing techniques, and computational design enhancing performance and reliability. Gear mechanisms not only drive technological progress but also inspire creativity and problem-solving in engineering disciplines. In conclusion, gear mechanisms represent a cornerstone of mechanical engineering, embodying the principles of precision, efficiency, and reliability. As technology advances and new challenges emerge, gear systems will remain indispensable tools, propelling industries forward and shaping the future of innovation and automation.

Vision of this model is considered from Make in India logo, converting it into working model using Spur Gears, Ball Bearings, Ac Motor, Joints and Led Lights to Make it an artistic model.

Workout Output is Making leg moment from Gear Rotation

Make in India Lion Gear logo

II. LITERATURE SURVEY

A. Experimental and Study of Gear Dynamical Transmission by Noel Francis, Zongde fang. Gear dynamical transmission, a cornerstone of mechanical engineering, plays a pivotal role in power transmission, speed regulation, and motion control across various applications. This short abstract delves into the fundamental principles and significance of gear dynamical transmission, emphasizing its efficiency and precision in transferring motion and power within mechanical systems. By elucidating key concepts and applications, this brief overview provides insights into the foundational role of gear dynamical transmission in modern engineering practices.

B. A Review on gear Trains by Vikassen, Jaskaran Thakur and Harpreet Singh Goryan Gear trains are mechanisms composed of multiple gears that work together to transmit motion and power from one shaft to another. They are essential components in various mechanical systems, providing speed reduction, torque multiplication, and direction changes. Gear trains consist of different types of gears such as spur gears, helical gears, bevel gears, and worm gears, arranged in specific configurations to achieve desired outcomes. By combining gears of different sizes and tooth counts, gear trains can alter rotational speed, torque, and direction according to the requirements of the application. They are widely used in automotive transmissions, industrial machinery, clocks, and numerous other devices where controlled motion and power transfer are essential.

C. Oscillation of gear mechanisms of construction machines by Using FEA by Vladimir Skel This paper describes the influence of gearing errors on the vibration activity of the open gear transmission of construction machines features of open gears of turning mechanisms of construction machines are highlighted: a large gear ratio, a large gearing module, the absence of a common frame for the gear and wheel, poor transmission lubrication conditions, a small degree of precision in the manufacture of gears and the actual overlap coefficient is close to one results of the study of the influence of these features of vibration damping and open gear transmission on the dynamics of the turning mechanism of the construction machine are presented.

III. Outcomes of opting this project

- **Understanding of mechanics:** Through research and analysis of lion movements and characteristics, participants gain a deeper understanding of mechanics and how they can be applied to mechanical engineering.
- **Design Skills Development:** Participants develop design skills by conceptualizing, modelling, and prototyping the Lion Gear mechanism. They learn to translate conceptual ideas into practical engineering solutions.
- **Hands-on Experience**: Building a prototype of the Lion Gear mechanism provides participants with hands-on experience in manufacturing, assembly, and testing. This practical experience enhances their understanding of engineering principles and techniques.
- **Problem-Solving Abilities:** Participants encounter challenges during the design and development process, requiring them to problem-solve and iterate on their designs. This fosters critical thinking and problem-solving abilities.
- **Interdisciplinary Learning:** The project bridges biology and mechanical engineering, fostering interdisciplinary learning. Participants explore the intersection of different fields and gain insights into how biological principles can inform engineering design.
- **Project Management Skills**: Managing a project involves setting objectives, allocating resources, and coordinating tasks. Participants develop project management skills as they plan, execute, and monitor the progress of the Lion Gear model project.
- **Presentation and Communication Skills:** Participants refine their presentation and communication skills by documenting their findings and presenting their project to peers, instructors, or stakeholders. This enhances their ability to communicate technical concepts effectively.
- **Creativity and Innovation:** Designing a Lion Gear mechanism encourages participants to think creatively and innovate. They explore unconventional design concepts and push the boundaries of traditional engineering approaches.
- **Career Development:** Engaging in a project like this can bolster participants' resumes and portfolios, demonstrating their practical skills and innovative thinking to potential employers or academic institutions.

IV. Design & Calculation:

$N_P = 100$

$P_r := 2 . 10^3$

VR:=2

$\phi := 20$**deg**

1. Select tooth profile
20 deg involute

2. Select number of teeth on pinion and gear
Tp:=20 Tg:=Tp.VR
Tg=40
Tr:=Tp.VR=40

3. Diameter of Pinion
Dp = Tp.m → Dp = 20.m

4. Pitch line velocity, Vp in m/sec in terms of m
Vp =
Vp =
Vp = 0.150 * m

5. Calculate Design Power Pd
Kl:=1.5
For medium shock
Pd := Pr.Kl = 3 . 10
6. Calculate Tangential and Tooth Load Ft in Tearms of m
Ft =
Ft = ___

7. Select material and basic strength
Material: SAE 3245
So:=530

8. Bending Strength Fb by lewis equation

:=f10 Cv:=0.3 b = f.m γ p := 0.485 − ___ γ p
:= 0.485 − ___
(Select the minimum value) γ p =0.342 γ g =0.413
Fb = So.Cv.b.γ.m

Fb = 530 * 0.3 * (10 * m) * 0.342 * m

Fb = 542.985 . m^2

9. Find out Module
Equating Fb and Ft to calculate module m=3.751
10. Calculating Fb, Ft, Dp, b and Cv
Dp:= Tp.m
Dp:= 75.0
Vp =
Vp = 0.3927
Ft = ___
Ft = 7639.42 b := f.m
b = 37.5
Cv = ___
Cv = 0.884

11. Calculating Actual width of pinion Actual width can be calcualted by equating the real values of Fb, Cv, γ ,m,So and must be within range of
8.5m<b<12.5m
Fb = So.Cv.b.γ.m = Ft b=12.729
Check_For_Width ((b)) = “Calculated Width is out of Range”

If b is out of range, then assume any value of b within the range and again calculate Fb b:=New Width ((b)) =31.875
b=32
Fb := So.Cv.b.γ.m
Fb = 1.921 . 10 4
[Check_For_Felure ((Fb, Ft) = "Design is Safe"]

12. Calculating Dynamic load by Buckingham's Theorem
C:=11800 e:=0.05 Vp=0.393

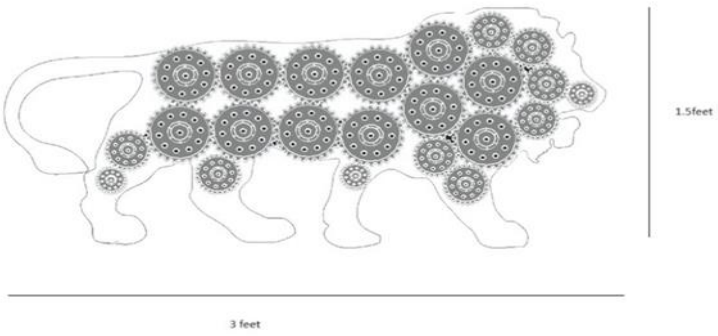
$c*e*b)+F_t)$ _____

:=
Fd Ft + *√)

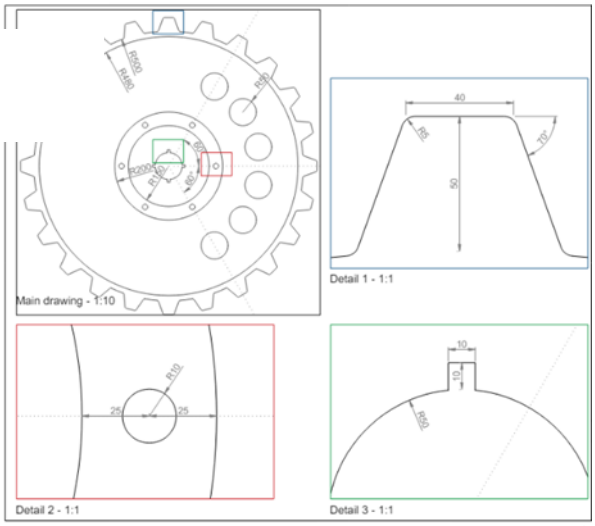
13. Calculating Wear Load

Q = ____
Q =1.333
Fw=Dp.b.K.Q
Fw=3200.0.K
13. Equating Dynamic load with limiting wear strength
Fw=Fd
K=2.787
Equating Dynamic value of load stress factor towards higher side, we get Hardness of Gear and Pinion
Gear Hardness: 600 BHN
Pinion Hardness: 600 BHN K:=6.156
Fw := Dp.b.K.Q = 1.97 . 10 4
[Check_For_Felure ((Fw, Fd)) = "Design is Safe"]

14. Calculating Endurance Strength
Seb:=700 …… (For 600 BHN steel Seb = 700Mpa)
Fen := Seb.b.γ.m → 28686.0



2D design of lion Gear using AutoCAD



2D design of Single spur gear using AutoCAD

V. Material Fabrication and Alignment:

1. The Reason for selecting sheet metal specifically for making this model was to gain good strength , sustain load and vibrations generated from rotation of gears , and to make any changes if required such as drilling , welding and other fabrication works overall size of modelmis
3 feet X 1 feet

Fig 1.1

2.We selected Spur Gears as They are more efficient than rest of the other gears,
Risk of Teeth Slipping is less, design complexity is less total no of gears used are 16 with additional bearing for free moment of gears

3. After checking for alignment of gears both sheets were joined and gears aligned were marked and drilled accordingly. When the base frame is ready stand was made accordingly to hold the whole model. Bearings are placed in drilled holes for rotational free motion of gears

4. wiper motor which AC motor is used for moment of gears, it is been placed in between both the sheets and connected to centre gears which moves rest all of the gears.
5. Used gears are silver painted, once they are dried they are considered for alignment and fitting in sheet, once the gears are aligned viper motor is attached to main gear or driver gear.

Fig 1.2

Fig 1.3

Fig 1.4

Fig 1.5

VI. RESULT AND DISCUSSION.

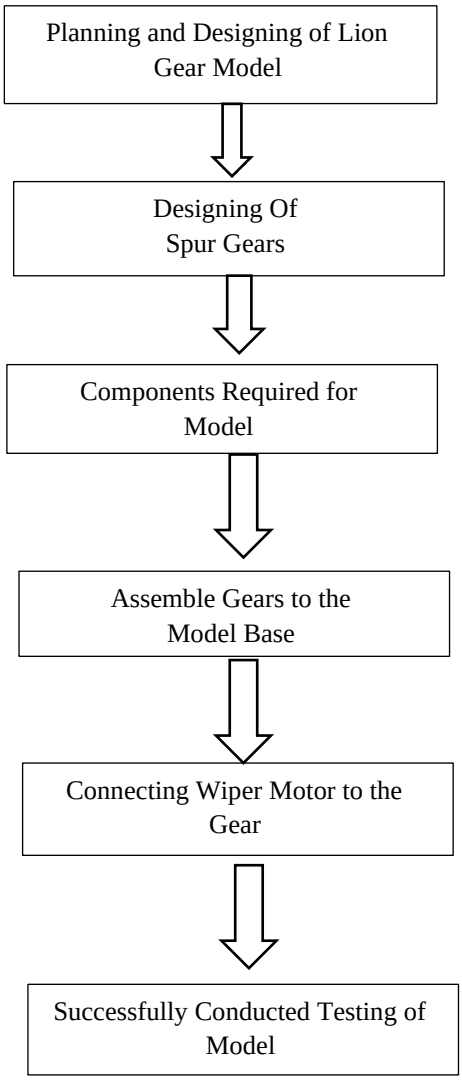
Base Frame Size
Total no of gears
Total no of Bearings used: 17
Motor: 3phase 12 V Wiper motor
Adaptor: AC to DC Motor SMPS Adaptor
Total use time: 20mins

Based on these measurements and component the lion gear mechanism is developed with frame size of 3feet X 1.5 feet, Total use time is 20 minutes.
Our team has developed the lion gear mechanism based on concept of Make in India Logo. The model is equipped with an Artistic Design of lion that has gears mounted on it. It has Wiper Motor to rotate the gears in rotary motion to carry

out gear meshing theory. Our Model is Learning model for upcoming students to understand concept of meshing, Gear Trains.
overall, we think that our model will provide an efficient and good artistic look for Make in India concept and it would help students to learn.

This is the final look of our desired model where all the components are aligned both the sheets are joined, Holes are drilled which were marked during placement of gears, after drilling operation Ball Bearings were placed in drilled holes of the free moment and gears were aligned in it , wiper motor is attached to main driver gears so that it rotates rest all the gears. Smps adapter is used for motor to avoid motor breakdown.

VII. Methodology



VIII. ADVANTAGES, DISADVANTAGES, APPLICATIONS

ADVANTAGES	DISADVANTAGES	APPLICATIONS
Efficiency	Complexity	Automotive Industry
Precision.	Potential for Wear	Industrial Machinery
Controlled Speed:	Noise and Vibration	Aerospace Industry
Compatibility	Temperature Sensitivity	Robotics

High Torque Capacity	Weight	Marine Industry
Wide Range of Ratios:	Skill Requirement	Mining and Construction:
Standardization.	Complex Assembly	Railways

IX. FUTURE SCOPE

- **Engineering Ingenuity:** The design and implementation of gear systems showcase human ingenuity and innovation in optimizing power transmission for various applications.
- **Reliability and Durability:** Gear models have proven their reliability and durability in countless industries, contributing to the efficiency and longevity of machinery and equipment.
- **Ethical Considerations:** Ethical considerations, including worker safety, fair labour practices, and environmental responsibility, shape the development and implementation of gear models in the global market.
- **Continuous Improvement:** The pursuit of excellence and continuous improvement drives research and development efforts to enhance the efficiency, reliability, and performance of gear models.
- **Legacy and Heritage:** Gear models carry a rich legacy of craftsmanship, engineering excellence, and technological progress, inspiring future generations of engineers and innovators.
- **Modification:** Various types of gears can be used
- **Supply Chain Optimization:** Integration of blockchain technology for transparent and secure supply chain management in gear manufacturing, ensuring traceability and accountability.
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- **Movement:** Legs and Mouth Movement can be obtained by other mechanisms
- **Alternate Material:** Gears Material can be differed such as plastic gears can be used as alternative
- **Size:** Size can be elaborated as we have done it in small size due to time restrictions.

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