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Design and Development of Wheel Dolly for Light & Heavy Motor Vehicle Tyre Lifter

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ABSTRACT: -

This project presents the design and development of a wheel dolly, specially tailored for lifting tires of light motor vehicles and heavy motor vehicles. The aim of this project is to enhance the wheel mounting and dismounting process of vehicles while also reducing human effort, particularly for heavy vehicle tires which are difficult to handle during vehicle maintenance. Our main objective for this project is to create compact-sized tire-lifting equipment at a low cost. This type of dolly is designed to overcome the challenges regarding wheel mounting, dismounting, and moving. This project was executed through a process of concept making, design making, prototyping, and testing. The final design integrates robust materials, easy controls, and ergonomic features to ensure ease of operation and reliability in difficult operational environments. The developed wheel dolly shows its potential to significantly improve productivity and decrease effort in the automobile maintenance of light and heavy motor vehicles.

1. INTRODUCTION PROBLEM STATEMENT:

In automotive workshops and service stations, the task of removing and mounting vehicle wheels, especially heavy or oversized ones, poses significant ergonomic and safety challenges. Mechanics often face difficulties in aligning the wheel with the hub bolts manually, which can lead to physical strain, improper installations, or accidental damage to vehicle components. The process typically requires either excessive manual effort or assistance from another worker, which increases labor costs and reduces efficiency. The mechanism is a prototype design of a wheel dolly that utilizes a rack-and-pinion setup supported by two parallel dampers to provide controlled horizontal movement for accurate wheel alignment. This system aims to minimize human effort while ensuring precise and safe wheel handling.

2. REASON FOR DEVELOPMENT:

The wheel dolly system improves ergonomics, safety, and efficiency in wheel servicing. It eliminates heavy lifting and awkward positioning, reducing injuries like back strain. Its rack and pinion mechanism ensures smooth controlled movement, while dampers stabilize the wheel during installation. A single operator can align wheels precisely, preventing stud damage. This innovation boosts productivity in tire shops, fleet maintenance.

3. SELECTION: -

The selection of this wheel dolly design was based on several key performance and practical criteria. First, the dolly must support a wide range of wheel sizes and weights, including those from light-duty to heavy-duty vehicles. The current design includes a robust rack gear for horizontal motion, which allows fine adjustment of wheel position. The two vertical dampers provide support and load balancing, ensuring that the wheel stays level during installation. The design is compact, cost-effective, and made using easily available materials like steel plates, threaded rods, and standard mounting brackets. Additionally, this dolly can be customized or modified for different vehicle types, and its mechanical simplicity ensures low maintenance and easy repair. Overall, the dolly was selected to meet the dual goals of precision and practicality, improving workplace safety and reducing service time.

4. WHEEL TYRE LIFTER: -

A wheel dolly is a mechanical tool used in vehicle maintenance and repair workshops to assist in the removal, transportation, alignment, and installation of wheels particularly those that are heavy or difficult to maneuver manually. The device reduces the physical strain on mechanics, ensures proper wheel alignment with hub studs, and improves overall workshop efficiency and safety. It is designed to handle both light and heavy vehicle wheels by supporting and guiding the wheel in a stable and adjustable frame.

Fig.1 Wheel Dolly

5. CASE STUDY: -

1. The conventional Wheel Tyre Lifter takes approximately 5 minutes for loading and unloading. Also, more power and skill required for workers to do loading and unloading operations. But if we use the wheel tyre lifter then the loading unloading time is reduced to approximate 1 minute's which results in **minimizing time and effort for tasks**.
2. Provide a cost-effective solution for automotive service businesses by **reducing labor costs and improving overall workflow efficiency**.
3. **Increase the productivity** of automotive workshops and service centers.

6. ADVANTAGES: -

1. Minimizing time and effort for tasks.
2. Reducing labor costs and improving overall workflow efficiency.
3. Increase the productivity of automotive workshops and service centers.
4. Compact in size, low weight and stable
5. Minimizing time and effort for tasks such as tire changes and brake maintenance.

6. APPLICATIONS: -

1. Tire Changing:
Hydraulic bottle jacks are commonly used to lift vehicles, allowing for tire changes and maintenance.

2. Suspension Work:
They are utilized for lifting specific areas of the vehicle to perform suspension and brake system repairs.

3. Undercarriage Access:
Hydraulic bottle jacks provide access to the undercarriage of vehicles for maintenance tasks such as oil changes and exhaust system repairs.

4. Emergency Situations:
They serve as crucial tools in emergency situations such as roadside repairs and recovery operations.

5. Load Support:
Hydraulic bottle jacks are employed to stabilize or support vehicle loads during repairs or maintenance work.

6. Body Repair:
They help in lifting vehicles to access the underside for body repairs and restoration work.

7. FUTURE SCOPE: -

1. Lifting Capacity:
Ability to lift a range of vehicle sizes, including cars, SUVs, and light trucks.
Ensuring the lifter can handle various wheel weights and sizes.
2. Adjustable Height and Width:
Capability to adjust the height and width to accommodate different vehicle types and wheel configurations.
Providing flexibility for lifting vehicles with varying ground clearances.

4. Safety Mechanisms:
Incorporation of safety features such as locking mechanisms to secure the lifted vehicle in place.
Consideration of safety standards and regulations to ensure user and vehicle safety.

5. Mobility and Maneuverability:
Incorporation of wheels for easy movement and positioning in the garage or workshop.
Ensuring the lifter is easy to transport and store when not in use.

6. Durability and Stability:
Use of durable materials and construction to support the weight of the vehicle.
Providing stability and balance during lifting and maintenance operations.

7. Efficient Operation:
Implementing a user-friendly design for smooth and

efficient lifting and lowering of the vehicle.
Incorporating quick setup and operational procedures to save time for technicians.

8. Compatibility with Automotive Systems: Integration with other automotive tools and equipment for seamless operation during maintenance and repair tasks.
Connectivity with vehicle diagnostic systems for advanced servicing capabilities.

8. CONCLUSION: -

1. Wheel dolly increased Easy of handling and maneuverability at service stations.
2. Wheel dolly enhanced Efficiency – Adjustable lifting capabilities improve workflow and productivity.
3. Wheel dolly is having universal Compatibility – Fits all Light Motor Vehicles (LMVs) in height, width, and length.
4. Wheel dolly is cost-Effective Fabrication – Durable materials ensure safety and stability at minimal cost.
5. Wheel dolly isuUser-Friendly Operation – Quick setup and smooth lifting/lowering for hassle-free use.
6. Wheel dolly works seamlessly with other automotive tools and diagnostic systems.

REFRENCES: -

1. Paper 1. Wheel-Dolly for Vehicle Towing and Recovery Arden Royce Shubert, 1920 Sheely Dr. Fort Collins, CO (US) 80526.

2. Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Editor: David Crolla, Publisher: Butterworth-Heinemann, Publication Date: August 13, 2009, Edition: First, Pages: 834, ISBN-10: 1856175774, ISBN-13: 9781856175777, Volume: Single-volume comprehensive reference.

3. Tire and Vehicle Dynamics, 3rd Edition Author: Hans B. Pacejka, Publisher: Butterworth-Heinemann, Publication Date: April 2012, Edition: Third, Pages: 672, ISBN-10: 0080970168, ISBN-13: 9780080970165, Volume: Single-volume technical reference.

4. B.L. Juneja, 1997, "Fundamentals of metal cutting and Machine Tools", 3rd Edition, New Age International Publications.

5. M.B. Bankar, P.B. Kadam, M.R. Todkar, "Improvement in design & manufacturing process of multiple spindle drilling attachment", JMCE, ISSN: 2278-1684, pp, 60-69.

6. Kyung-Hee Park, Aaron Beal, Dave (DaeWook) Kim, Patrick Kwon, Jeff Lantrip, 2014, "A Comparative Study of Carbide Tools in Drilling of CFRP and CFRP-Ti Stacks", ASME, Vol. 136, pp. 014501-1.

7. P.R.Sawant and R. A. Barawade, 2012, "*Design and development of spm-a case study in multi drilling and tapping machine"*, IJAERS, Vol. I, Issue II, pp. 55-57.
8. A. Dolgui, I. Ihnatsenka, 2009, "Branch and bound algorithm for a transfer line design problem: Stations with sequentially activated multi-spindle heads", European Journal of Operational Research, Vol.197, pp. 1119–1132
9. M.B. Bankar, P.B. Kadam, M.R. Todkar, "Improvement in design & manufacturing process of multiple spindle drilling attachment",JMCE, ISSN: 2278-1684, pp, 60-69.
10. GN Rakate, PV Jadhav, VR Patil, RA Barawade, PV Shinde, VS Gondkar,2023"Bearing element integrity analysis using dimensional analysis and response surface method (RSM) for fault diagnosis of rotor bearing system", AIP Conference Proceedings, Vol 2716, Issue 1
11. R.A.Barawade, P.M. Gavali, P.V. Shinde ,Y.B.Mohite,2016/5" Design and Development of Special Purpose Machine (SPM) – A Case Study in Multi Drilling of Impeller" International Journal of Trend in Research and Development,Vol. 3,Issue 3

12. Y.B.Mohite, P.B.Shinde Prasad V.Shinde, P.M.Gavali, R.A.Barawade,2017" A Review on Muffler Design for Exhaust Noise Attenuation" International Journal of Engineering and Technology (IJET)"Vol. 9, Issue 3S