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Design and Fabrication of Automatic Tyre Removal and Mounting for Four Wheeler

Swapnil Deokar[1], Rushikesh Pund[1], Pranav Patil[2], Pranav Chaudhari[3], Third Dipak Nakade[4]

Department of Mechanical Engineering, SKNCOE, SPPU, Pune

Abstract— **The project's main objective is to build a four-wheeler nut-removing tool that can constrict and remove four nuts simultaneously. With more cars on the road, tyre failure is now a more common cause of automotive issues. An L-shaped nut extractor and a jack given by the manufacturer are among the instruments for changing tyres that are almost always included with vehicles. However, it is difficult for women and senior drivers to operate the vehicle due to the considerable torque required to release the wheel nuts. If the nuts are successfully removed, the problem of retightening the nuts will also present itself. If the required torque is not applied, the nuts will stop being tightly fastened, compromising the driver's safety. the creation of a tool using a double crank system. The creation of a single tool that can be used for both wheel installation and wheel disassembly in automobiles is the main objective of the work. Additionally, it applies to garages, petrol stations and workshops. The nut extractor can remove all nuts at once and is designed to be ergonomic to use, easy to maintain, easy to store, and easy to handle. In order to fix all four nuts on the four-wheeler tyres with the least amount of manual labour and time, this project will use several operated spanners.**

Keywords— **Mounting, Removal, Dual crank mechanism, wiper motor, minimization human efforts**

I. INTRODUCTION

With the ability to change and maintain their direction of travel, absorb road shocks, sustain their weight, and transmit traction and braking forces to the road surface, tyres are a feature of cars that aid in getting them from one point to another. When a car's tyres occasionally experience a problem, the driver must remove the tyres to fix it. The problem of tightening the nuts does arise regularly, even when they have been removed efficiently. Additionally, the driver's safety is at jeopardy if the nuts are not tightened with the required torque. A box spanner or torque wrench is the most common instrument for tightening or loosening the nuts from the bolts in a car's wheel, although tightening and unbolting the wheel nuts is a tiresome process. The main objective of this project is to automate the time-consuming task of manually tightening or loosening each screw. The objective of this project is to use a large number of operated spanners to rapidly and efficiently fix all four nuts on a four-wheeler tyre. Traditionally, any wheel is fastened to a vehicle using nuts or bolts along its specific PCD, and it is unfastened by removing the nuts or bolts. We came up with the idea of using automation to enable wheel attachment on any vehicle. This automation is already present in business on manufacturing lines. However, they are neither transportable nor affordable. To do this, a double-crank system is created. A system that requires less time and effort to complete the previously mentioned procedure of releasing or releasing the wheel nut is an affordable option. The main objective of this project is to automate the time-consuming task of manually tightening or loosening each screw. The objective of this project is to use a large number of operated spanners to rapidly and efficiently fix all four nuts on a four-wheeler tyre.

II. LITERATURE SURVEY

Popular pneumatic or electrically powered torque-responsive powered screw drivers have a comparatively fast rotational speed to achieve a quick screwing time. The maximum moment of tension for the screw to be screwed requires a determined torque, even though a high torque is only required for a short time during the tightening of the screw. Therefore, the driving power of the screw driver must also be made high in accordance with the relatively high speed of rotation. The amount that the screw can be tightened is often controlled by ratchet couplings or striking mechanisms. The degree of tightening must be maintained constant within a very narrow range because these screws are stressed almost to their yield point when screwing in. Screwdrivers with shock and torque reactions are useless for this. The number of strikes utilised, which cannot be kept constant because to the quick succession of blows, determines how much tightening is achieved. Due to the unpredictable reactions of the work piece, screw, and screwing tool to the striking operation, the power of each blow also fluctuates widely.

III. METHODOLOGY

An initial phase of this project's work was a literature and market survey. We gathered a number of studies that were pertinent to our problem and studied them to comprehend the autonomous cow feeding system. Following our understanding of the findings of the market survey, we have selected our standard and essential components for this system. After the part was

developed, we used ANYSIS software to assess it and produce a safe model before using the CATIA tool to create a 3D model. The components will be created and assembled as a whole.

IV. COMPONENTS

A. WIPER MOTOR

Any of a collection of electrically powered rotating machinery referred to as DC motors converts electrical energy from direct current into mechanical energy. Most types depend on magnetic field forces. Nearly all types of DC motors have an internal electromechanical or electronic system that enables them to sporadically change the direction of the motor's current flow. Variable stator and armature field counts and connections lead to a variety of natural speed- and torque-regulating features. The voltage applied to the armature of a DC motor can be changed to adjust its speed. By introducing variable resistance to the armature circuit or field circuit, speed control was made possible. Wiper motor as shown in Fig. 1

Fig. 1 Wiper Motor

Motor Specifications:-
Voltage: 4V to 12V
Brush Type: Carbon
RPM: 45 at 12V
Stall Torque: 85 To 90 N-m

B. Plate

It is generally available in a rectangular shape. These are the main components that hold all other components on them. A dual crank mechanism is placed on the plate. Plate as shown in Fig.2

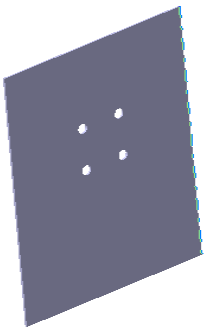

Fig. 2 Holding plate

C. LINKAGES MECHANISM

It is the rotating part that is attached to the nuts of the tyre for tightening and loosening. It works on the principle of the double crank mechanism. The output of the wiper motor is supplied to this mechanism, which rotates the nuts. Linkages Mechanism as shown in Fig. 3

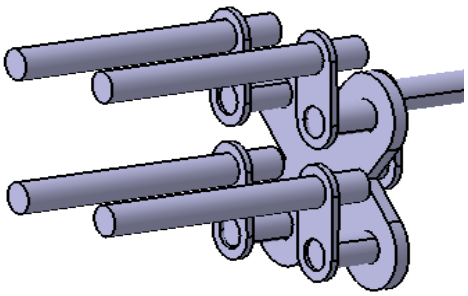

Fig. 3 Linkages Mechanism

D. CAD MODEL

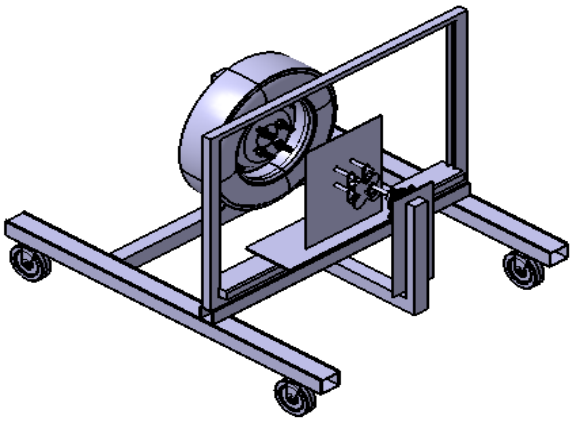

Fig. 4 Project setup

It functions with the fundamental premise that a DC wiper motor can swiftly and automatically remove wheel nuts. It doesn't need any unique skills to work; it only needs a fundamental understanding of how the setup works. First, a vehicle wheel nut is used to position the machine setup with the proper base fittings. The DC motor is attached to the power source. The motor turns the twin crank mechanism. This has to do with nuts. Therefore, the rotation of the socket, which rotates along with the shaft, releases or tightens the nut in the wheels. The tightening and untightening operation can be changed by changing the motor's spin. The wheel nuts can thus be tightened and released using this technique. The four nuts are simultaneously turned. This concept is quite useful in practice. As a result, we were able to develop a viable method for the wheel replacement process employing this simple strategy. This shortens the time and effort needed to change a four-wheeler's tyre. Project setup is shown in Fig. 4 Project setup

V. CONCLUSIONS

It functions with the fundamental premise that a DC wiper motor can swiftly and automatically remove wheel nuts. It does not need any specialised knowledge in order to work; merely a basic comprehension of the setup For removing the tyres from every vehicle to cut down on the amount of time and labour needed to replace the tyres and handle emergency scenarios.

The vehicle multi tyre nut remover and tightener can be used in any auto shop and kept in every vehicle for on-the-spot tyre replacement, which saves everyone a great deal of time and effort.

When considering the potential for the future, like in MotoGP and Formula 1 racing, it will be quite useful.

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