AUTOMATIC MOVABLE JACK

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Abstract: Tire puncture is ordinarily ascertained now-a-days. Automobile jack comes with vehicles needs users to use manual force to carry a vehicle. This paper is targeted to research the event in existing cut automobile jack so as to make load lifting easier by utilizing lead-acid battery (12V) which may be employed in emergency things. During this style, the cigarette lighter receptacle purpose is connected in automobile that drives the facility from the lead-acid battery (12V), this may run the DC motor and therefore connected power screw is turned. By this, the automobile jack can carry the vehicle and move the automobile on jack as wheels are welded below the jack. The contractions or growth movement of automobile jack is controlled by a joystick as per needs. This changed automobile jack will be simply operated by a person and it saves time, thus scale back wastage of human efforts and time. The planning of this automobile jack is being developed in Solid Works 2018 computer code. Producing and fabrication work are done using edge, drilling, grinding and threading machines. The changed automobile jack is tested and implementing of style can solve engineering science issues.

Keywords: electric automobile jack, flat tires, crush injuries, enhancements in jack, high safety options, lead-acid battery, simple to control

1. INTRODUCTION

An automotive jack could be a device want to raise all or a part of a vehicle into the air so as to facilitate repairs. the majority are aware of the fundamental automotive jack (manually operated) that's still enclosed as normal instrumentation with most new cars. These days, a automotive jack is a crucial tool to own in our vehicle because of unknown approaching event like flat tyre in our journey. Even so wish to rotate their tires themselves or who might install snow tires before the winter and take away them within the spring have to be compelled to use a jack to perform the work. Changing flat isn't a pleasant expertise. Women have a way lighter skeleton which suggest, among various things, woman can't pull loads of forces as compared to men and are at larger risk of skeletal injuries. Sometimes the automobile advisedly tries to urge a flat at the smallest amount opportune moments. On average, a hundred and sixty injuries are related to automotive jacks every year. Injuries have ranged from amputation to ligament tear, fracture and crush injuries. The proper use of jacks will stop Death or Injury. Improvement in automotive jack is actually required to form the tool a lot of economical, easy, sensible to use, changes in business direction and most significantly high safety options. Additional analysis on automotive jack is extremely vital. In operation the manual automotive jack is sort of troublesome job for pregnant ladies and recent men. The aim of this project is to encounter these issues. An electrical automotive jack works on current provide from the lead-acid accumulator itself creating it straightforward to control. Operator solely must press the button from the controller while not operating during a bent or squatting position for a protracted amount of your time to alter the tire. so as to satisfy the requirements of gift automotive jack, some improvement should be created

2. OBJECTIVE

Sometimes car's tyre gets inflated in middle of road while driving which causes man problems to the driver as many of us don't know how to fix a puncture tyre and replace them with a new tyre and even if someone knows often find it difficult to change because of the tiring process and complicated process. Sometimes people also drive to various functions or office meetings so they also could destroy their clothes while fixing the tyre. So to solve such problems we have developed this project in which an automatic jack is already installed beneath the car and it can be opened through a press of switch using motors. This makes the task much easier as installing the jack below the car was the toughest part. After the jack is installed on the shaft below the car it takes and drives the car on its own and there is no need to change the tyre now.

There are four free wheels which are installed below to car to drive the car when tyre gets inflated. Then tyre can be changed by taking the car to the garage whenever you want.

This system is very helpful for the people who are not physically capable of changing the tyre and physically disabled people. It is also very useful for the people who are rushing somewhere or going to a function or meeting where they want to be presentable.

It is economical and easier to use. It can be installed beneath the car without even realizing

COMPONENTS OF MOTORIZED JACK

The main elements that are essential for development of motorized cut automotive jack are:

1. FRAME
2. SCREW JACK SYSTEM
3. A DC MOTOR
4. CONNECTING SHAFT AND GEAR.
5. BATTERY
6. WIRES AND SWITCHES
7. WHEELS

Fig. 1 OVERALL ASSEMBLY

ADVANTAGES

1. The main motto of using automatic screw jack is that they have self-locking system.
2. The self-locking system means when the rotational force of motor on the screw is removed then it'll remain motionless where it had been left and cannot rotate downwards, even though huge force acting on it.

3. CALCULATION

W = 4500N
Ground clearance = 200 mm
Minimum lift = 60 mm

For fully extended jack -

Tan θ_{max} = 157.5°/55°

Tan θ_{max} =2.86

Tan θ_{max} =70.727°

For fully closed jack –

Tan θ_{min} = 57.5°/135°

Tan θ_{min} =0.425°

Tan θ_{min} =23.035

For designing a screw: -

Σ F(horizontal) = 0
(F1 * cos) – W/2 = 0
F = W/ (2tan)
= 4500 / (2*tan (23.025))
F = 4500/ (2*0.424)
F = 4500/ 0.848
F = 5306.603

W = 2F = 2*5306.603
W= 10613.206 N

σyt= 834 N/mm²
τs= σyt / 2

FOS (N) = 3
Service factor (K) = 1.6

σ **allowable** = σ yt / (K*N)
= 834 / (1.6*3)
= 173.75 N/mm²
τ allowable = σ allowable / 2
= 173.75/2
= 86.875 N/ mm²

173.75 =10613.20/ ((π/4) * d²)
Core diameter (d²)
=10613.20/136.4
62 d²=8.8187mm
Screw is subjected to torsional shear stress, so, **Core diameter (dc)**=11.5mm
Pitch (p)=3mm

Outer diameter (do)= dc + P = (11.5+3) = 14.5 mm **Mean diameter, D**= do – P/2 = 14.5-3/2 = 13 mm

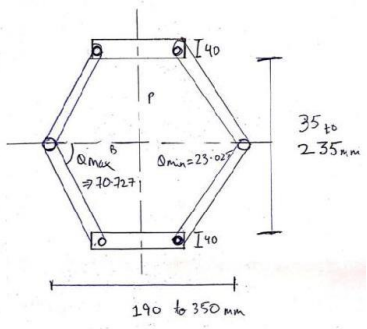

Fig. 2 Dimensions as per fully extended and closed position

For ACME Thread,
$\alpha=14.5°$

Helix angle (λ) = tan-1(1 / π*D)
= tan-1(1 / π*13)
=1.402°
Coefficient of friction (μ') = μ/ cos α = 0.15/ cos14.5 = 0.154

Friction angle (Ø) = tan-1 (μ)
= tan-1 (0.1544)
= 8.8028°
Required Torque (Tf) = (W*D /2* (tan θmin)) * tan (Ø + λ)
= 4500*13/ 2*(tan 23.025) * tan (8.8028+1.402) =12389.55 N-mm

Efficiency of thread (η) = (1-sin Θ)/ (1+sin Θ)
= (1-sin 8.8028)/ (1+sin 8.8028)
= 73.427%

Actual torque required (τ) = Tf/ η
= 12389.55/0.7343
Nmm =16874.89 Nmm
Direct tension stress (σt) = (W)/ (π/4 *l²)
= (10613.20)/ (π/4 * 11.5²)
= 102.178 N/mm²

Shear stress due to torque = (16*T)/ (π/4 *dc^3)
= (16*16874.89)/ (π/4 *11.5^3)
=56.508 N/mm²

Maximum principle tensile stress theory (σ)
= t/2 + o.5√ (t² + 4*S²)
= 102.178/2 + 0.5√ { (102.178)² + 4*(56.508)² } =51.089+76.17
σ = 127.267 N/m
σ = 127.267 < 173.75 N/mm²

Minimum principle stress theory (τ) = 1/2√[(σt)² +4 (τ)²]
= 1/2√[(102.178)² + 4(56.508)²]
τ = 76.17 N/mm²

τ = 76.17 < 86.875 N/ mm²

Hence, design is safe.

4. SPECIFICATIONS OF WIPER MOTOR AS PER PROJECT

12vdc Electric motor
Stall Torque 171.445(mN.m)
Max Efficiency 59.23%
Torque at peak efficiency 24.002(mN.m)
Current at load 2.146(A)
Power 15.91(w)
No load current=0.377(A)
400RPM
Pitch=3mm diameter of screw =12mm
All metal gears
Current draw 3amps
6mm dia shaft with flat
Motor can be replaced by tube actuators whose model is FA-04.

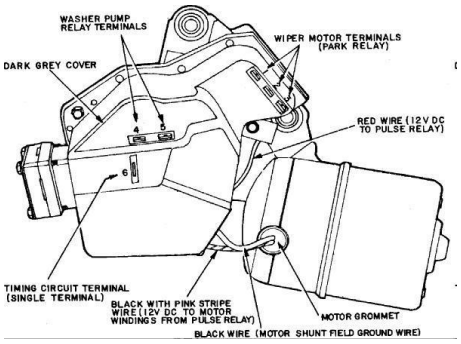

Fig. 3 DC Motor Assembly

5. CONCLUSION

This jack is very fascinating jack to become accessible in vehicles which will be operated by the electric D.C. Motor and also the electricity provided will be given to motor from vehicle battery

Fig. 4 DC Wiper Motor

Such a jack is should be compact. Therefore, it will easy to store in any vehicle or automobile. That whole style is management by a switch in order that jacking will be done from a foothold of safety. It ought to be simply movable and different support surface isn't needed. Thus, the look has been developed considering all the higher than necessities.

This can be helpful in lifting and lowering of automobile in any situation.
The existing style was changed by introduction of an electrical motor within the power screw, connecting gear with the pinion, the electrical switch connected to the motor and obstructed to the automobile 12V battery supply to get power for the first cause (motor), So as to make load lifting easier. During this changed style, the facility screw is turned through its gear. When voltage flows through it.

Fig. 5 permanently installed jack beneath The automobile (In extended position)

The maximum people who are physically challenged, ladies will be benefited by this new designed automatic movable jack as it can save time, be quicker and easier to work and needs less human energy and work with just a single two - way switch button. There by effectively curb the issues related to biotechnology - that may be a basic construct of style method. Considering all accessible automotive jacks within the market, this paradigm will be improved by some modifications on the options and style. The objectives area unit to style a automotive jack that's safe, reliable and able to raise and lower the extent, to develop a automotive jack that's supercharged by internal car power and automatic with button system. Based on the testing and results from the analysis, it was found safe to use this automatic movable jack under bound specifications. What is more the torque provided on the system is quite enough to elevate an automotive weight around 1200 metric weight unit. There area unit bound weak points which will be improved based style and equalization of the system.

PRACTICALLY INSTALLED & IN WORKING CONDITIONED JACK BENEATH THE MARUTI 800 -

Fig. 6 Movable Jack lifting Maruti 800

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