International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 09 | Sep -2017 www.irjet.net p-ISSN: 2395-0072

DESIGN AND FABRICATION OF AUTOMATED MOTORIZED MECHANICAL JACK

Asst Prof.Anand A. Kulkarni[1], Avinash V. Roy[2], Chaitanya Kale[3], G Praveen[4], Himalay Jakuti[5]

[1]Asst.Professor, Dept Of Mechanical Engineering, KLS Gogte Institute Of Technology, Belagavi, Karnataka, India.
[2,3,4,5] Dept Of Mechanical Engineering, KLS Gogte Institute Of Technology, Belagavi, Karnataka, India.

Abstract: *A jack is a device which is used to raise part of vehicle in order to facilitate vehicle maintenances or breakdown repairs.In normal jack system a mechanical jack is used for lifting the vehicles. The most common form is a car jack, garage jack, floor jack which lifts vehicles so that maintenance can be performed. Jacks are generally used to increase mechanical advantage (lifting the vehicle).Generally jacks undergo buckling when they reach maximum load conditions (as per the tests conducted by consumer affairs). For this reason, we have to develop the system which can use toggle jack which is automatic in operation using electric motor . Vehicle's battery can be used as a source of power for this motor. Our research in this regard reveals the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. This paper attempts to overcome this difficulty and a suitable device is to be designed such that the vehicle can be lifted from the floor without any application of impact force. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased.*

Keywords: **Jack, mechanical jack, electric motor, battery, consumer affairs.**

1.INTRODUCTION

There are mainly two types of jacks-Hydraulic jacks and Mechanical jacks. A Hydraulic jack consists of a cylinder and piston mechanism. The movement of the piston rod is used to raise or lower the load. Mechanical jacks are either hand operated or power driven. The main parts of mechanical screw jack (cylindrical) jack are Body, Screw, Nut and Thrust Bearings. In this type of a jack, the nut remains stationary while the screw rotates and helps in lifting or lowering the load. A screw jack is a portable device consisting of a screw mechanism used to raise or lower the load. The principle on which the screw jack works is similar to that of an inclined plane. Jacks are used frequently in raising cars so that a tire can be changed. A screw jack is commonly used with cars but is also used in many other ways, including industrial machinery and even airplanes. They can be short, tall, fat, or thin depending on the amount of pressure they will be under and the space that they need to fit into. The jack is made out of various types of metal, but the screw itself is generally made out of lead. While screw jacks are designed purposely for raising and lowering loads, they are not ideal for side loads, although some can withstand side loads depending on the diameter and size of the lifting screw. Shock loads should also be avoided or minimized. Some screw jacks are built with anti-backlash. The anti-backlash device moderates the axial backlash in the lifting screw and nut assembly to a regulated minimum. Large amount of heat is generated in the screw jack due to friction between various parts and long lifts can cause serious overheating. To retain the efficiency of the screw jack, it must be used under ambient temperatures, otherwise lubricants must be applied. The screw has a thread designed to withstand an enormous amount of pressure. This is due to the fact that it is generally holding up heavy objects for an extended amount of time. Once up, they normally self-lock so that they won't fall if the operator lets go, and they hold up well to the wear of repeated use.

Fig-1: Mechanical Screw Jack

2. LITERATURE SURVEY

Screw type mechanical jacks were very common for jeeps and trucks of World War II vintage. For example, the World War II jeeps (Willys MB and Ford GPW) were issued the "Jack, Automobile, Screw type. This jacks and similar jacks for trucks were activated by using the lug wrench as a handle for the jack's ratchet action to the jack. Screw type jack's continued in use for small capacity requirements due to low cost of production and ease of mobility. The virtues of using a screw as a machine, essentially an inclined plane wound round a cylinder, was first demonstrated by Archimedes in 200BC with his device used for pumping water. There is evidence of the use of screws in the Ancient Roman world but it was the great Leonardo da Vinci, in the late 1400s, who first demonstrated the use of a screw jack for lifting loads Leonardo's design used a threaded worm gear, supported on bearings, that rotated by the turning of a worm shaft to drive a lifting screw to move the load - instantly recognizable as the principle we use today. During the early 1880s in Coaticook, a small town near Quebec, a 24-year-old inventor named Frank Henry Sleeper designed a lifting jack. Like Da Vince's jack, it was a technological innovation because it was based on the principle of the ball bearing for supporting a load and transferred rotary motion, through gearing and a screw, into linear motion for moving the load. The device was efficient, reliable and easy to operate. It was used in the construction of bridges, but mostly by the railroad industry, where it was able to lift locomotives and railway cars. With the ability to be used individually or linked mechanically and driven by either air or electric motors or even manually, the first model had a lifting capacity of 10 tons with raises of 2 or 4 inches. More recent developments have concentrated on improved efficiency and durability, resulting in changes in both lead screw and gearbox design options for screw jacks.

3. NEED FOR AUTOMATION.

1. To increase the efficiency of the device.
2. To reduce the work load.
3. To reduce the overall operation (lifting & lowering) time.
4. To reduce the handling and fatigue of workers.

4. PRINCIPLE OF OPERATION.

The jack is raised and lowered with a metal bar that is inserted into the jack. The operator turns the bar with his hands in clockwise direction. This turns the screw inside the jack and makes it go upwards. The screw lifts the small metal cylinder with platform that are above it. The bar is turned until the jack is raised to the required level. To lower the jack the bar is turned in opposite direction.

5.MOTORIZED SCREW JACK

Our survey regarding several automobile garages, Service centers revealed the facts about difficulties faced during lifting the vehicles for reconditioning / maintenance. The motorized screw jack is developed to cater the needs of small and medium automobile garages, which are normally man powered with unskilled labors. Normally in the garages the vehicles are lifted by using screw jack which needs high man power and skilled labor. In order to avoid all such limitations, the motorized jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force. The operation is made simple so that even an untrained worker can use this device. Now the project has mainly concentrated on this difficulty, and hence a suitable device has been designed, such that the vehicle can be lifted from the floor land without application of any impact force. The fabrication part of it has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garages. The DC motor is coupled with the screw jack by gear arrangements. The screw jack shafts rotation depends upon the rotation of D.C. motor. This is a simple type of automation project. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased.

6.PARTS OF MOTORISED SCREW JACK

1. D.C. Motor.
2. Power screw.
3. Spur gear.
4. Battery.
5. Switch.
6. Remote control.

7.WORKING OF MOTORIZED JACK

The lead-acid battery is used to drive the D.C motor. The D.C motor shaft is connected to the spur gear. Spur gear is messed with main gear which is in-turn messed with lead screw of jack. When the power is given to the D.C motor, it drives the spur gear which in-turn rotates the lead screw

via main gear in messing with it. The lead screw moves upward, so that the vehicle lifts or object lifts from ground. The vehicle/object is lifted by using the lifting platform at the top of the lead screw. Lifting and lowering of jack is controlled using a remote control circuit also as a secondary controlling unit toggle switch is incorporated.

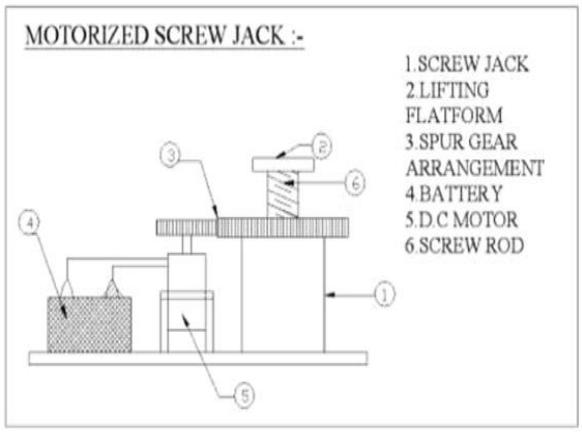

Fig-2: Motorized Screw Jack

REMOTE CONTROL

Transmitter Circuit Description: The transmitter is needed to activate with the supply from a 9V battery. When Push Button is switched on, 9V is supplied to the Frequency modulator. The frequency modulator modulates the base hand signal by a proper carrier frequency. The output of the modulator is supplied to a high power amplifier to raise the modulated signal. This modulated signal is finally fed to the transmitting antenna.

Receiver Circuit Description: The receiving aerial will receive the transmitted signal at the motor end. The received signal has unwanted energy, which is usually termed as noise. The noise can affect the receiver sensitivity. So the noise must be filtered, this filtering is done by the low noise amplifier block. These weak signals are then amplified so that it turns the relay circuit ON (i.e.) to activate the main contractor.

8. ADVANTAGES

1. Checking and cleaning are easy, because the main parts are screwed.
2. Handling is easy.
3. No Manual power required.
4. Easy to Repair.
5. Replacement of parts is easy.

9. LIMITATIONS

1. Cost of the equipment is high when compared to ordinary hand jack.
2. Since it involves electric circuitry device should be handled with care.
3. Care must be taken for the handling the equipment such as proper wiring connection, battery charging and check up.

10. FUTURE SCOPE

1. There is a scope of improvement that is by replacing the remote control with Bluetooth operating technology.
2. The device can also be designed to operate using android application.

11. RESULT

The jack which is designed has an efficiency of 29% whereas the normal jacks have efficiency of around 15% to 20%.

12. CONCLUSION

1. Normal jacks costs around 3000 rupees, the jack which is designed costs about 7000 rupees but this will be reduced when produced in large volume.
2. Since the manual effort to raise and lower the jack is completely eliminated by replacing the manual operation with a remote control the fatigue of the operator is reduced.

13. ACKNOWLEDGEMENT

We wish to express our deepest gratitude to all the people involved in completion of this report. We wish to thank Prof.ANAND V.KULKARNI our seminar guide for his constant help & guidance, without who's involvement this work would have remained incomplete We thank our beloved HOD Dr. S L.GOMBI who was there for support & encouragement throughout our work, We also thank Dr. A S.DESHPANDE, principal, GIT for providing a peaceful & student friendly environment. We are grateful to all our friends and family members for their direct or indirect moral support throughout the course of the project.Towards the end, we thank the Management of the institution and all those who have been a helping hand in the completion of this work.

14. REFERENCES

[1] V.B.Bhandari, Design of machine elements, 3rd Edition, Tata McGraw Hill, 2010.

[2] Rajendra Karwa, A text book of machine design,2nd Edition,Laxmi Publications,2006.

[3] V K Jadon and Suresh Verma,Analysis and Design of Machine Elements,2nd Edition,I.K. International Publishing House Pvt.Ltd,2014.

[4] T.A.Stolarski, Tribology in Machine Design,2nd Edition, Reed Educational and Professional Publishing Ltd,2004.

[5] R.S.Khurmi and J.K.Gupta, A text book of Machine Design, 25th Edition,S. Chand,2005.

[6] Farazdak Haideri, Design of Machine Elements,1st Edition,Nirali Prakashan,2005.

[7] S.G.Kulkarni, Machine Design,1st Edition, Tata McGraw Hill,2008.

[8] K.Rao, Design of machine elements,1st Edition,I K International Publishing House,2010.

[9] Robert L.Boylestad, Electronic devices and circuits, 10th Edition, Pearson Publication,2009.

[10] Jain and Jain, Textbook of engineering chemistry, 16th Edition, Dhanpatrai Publications,2013.

[11] H.G.Patil, Machine Design data handbook,2nd Edition,I.K. International Publishing House Pvt.Ltd,2014.