

Motorised Car Jack

ChaitanyaShahane, SwapnilKadam, Samiullah Ahmed
Khan, SanchitRaikar
B. E. Students, Department of Mechanical Engineering,
SCOE, Kharghar,
Navi Mumbai, India.

Prof. MadanJagtap (Guide)
Asst Prof. Department of Mechanical Engineering,
SCOE, Kharghar,
Navi Mumbai, India

Abstract--- Mechanical toggle Jack is widely used in the most automobile maintenance. Mechanical toggle jacks are available from the standard range in capacities from 5kN to1000kN (Metric) and 0.25 – 250 tons (imperial). Standard classic and sym-metric toggle jack configurations include upright or inverted translating toggle units with top plate, clevis or threaded end on lifting toggle and the option of keyed lifting toggle or anti-backlash feature, and upright or inverted rotating toggle with flanged lifting nut.

Machine toggle jacks offer positive mechanical actuation, precise positioning and uniform lifting speeds and can be used to lift, position loads, apply pressure or as linear actuators.

Button operated toggle Jack is equipped to design custom built “special” toggle jacks to suit all customer requirements to use it without physical efforts. With our experienced team of application engineers, we pride ourselves in determining the right product to fit your needs.

Keywords--- Mechanical Toggle Jack; Button Operated; No Physical Effort;

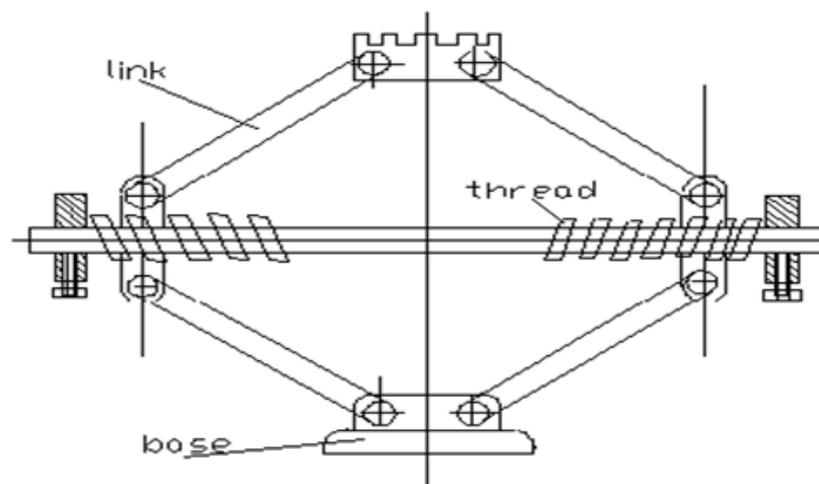
I. INTRODUCTION

Power Jacks is the largest and most experienced manufacturer of mechanical toggle jacks in the India. With over 2 million products in the field, you are assured of quality, reliability, performance and value.

Mechanical machine toggle jacks are available from the standard range in capacities from 5kN to1000kN (Metric) and 0.25 – 250 tons (imperial). Standard classic and symmetric toggle jack configurations include upright or inverted translating toggle units with top plate, clevis or threaded end on lifting toggle and the option of keyed lifting toggle or anti-backlash feature, and upright or inverted rotating toggle with flanged lifting nut.

Machine toggle jacks offer positive mechanical actuation, precise positioning and uniform lifting speeds and can be used to push, pull or position loads, apply pressure or as linear actuators.

Our wide range of standard machine toggle jacks offers you the combination of design flexibility and economy, with a standard model available for almost any requirement. Power Jacks is equipped to design custom built “special” toggle jacks to suit all customer requirements to use it with out physical effort. With our experienced team of application engineers, we pride ourselves in determining the right product to fit your needs



TOGGLE JACK WITH MOTOR AND GEAR BOX AS
MOTORISED JACK

II. CLASSIFICATION

The “jacks” are classified according to the following:-

- A. Pneumatically operated
- B. Hydraulically operated
- C. Rack and pinion operated

Among all above types, we have selected the worm geared toggle thread operated due to so Many advantages. Brief description of all the types we are mentioning for the sake of comparison.

A. *Pneumatically operated*

Here the advancement of the piston and the linkage along with the platform is carried out in the upward and the downward direction using the hydraulic piston and cylinder arrangement along with the platform and the linkage.

B. *Hydraulically operated*

Here the lowering and raising of the platform is carried Over using hydraulic piston and cylinder arrangement. Due to continuous accumulation of the comparatively low pressure oil in the load cylinder gives rise to tremendous increase of the pressure. This increased pressure is utilized to raise the platform using suitable linkage.

Using the hydraulic piston and cylinder arrangement. To actuate the piston and Cylinder, the oil is allowed to enter the cylinder from front or the back side of the piston.

C. *Rack and pinion operated*

Here the lowering and the raising of the platform along with the load to be raised is carried out manually using the rack and pinion arrangement. In this case the required pressure is applied manually using direct hand pressure on the rack using pinion and lever arrangement. It requires robust man for its handling. This is it's limitation.

Among all the above types we have selected the worm geared (in gear motor) Lead toggle thread Operated due to the following advantages :-

- 1) Its operation is smooth.
- 2) No compressor required.
- 3) It is compact
- 4)It requires less fatigue for its operation.
- 5)No electrical power required.

III. CASE STUDY

A. *Need*

Today's world required speed on each and every field. Hence rapidness and quick working is the most important. Now a days for achieving rapidness, various machines and the equipments are manufactured by the man. “Tons of speech is not equal to an ounce of practice.” Goes the professional saying. To prove that the same is true with our Institute we thought of having an innovative project.

The engineer is constantly conformed with the challenges of bringing ideas and design in to reality new machine and techniques are being developed continuously to manufacture various products at the cheaper rates and high quality. Also man is always thinking for bringing more and more changes in the presently available machines to improve it's productivity and efficiency. As a part of this we are thinking to modify such an accessory on the machine tool that will definitely help to improve the output of the machine tool.

B. *Objective*

The basic objective of the project is to find out the solution for the reduction in manual efforts, during the maintenance of vehicles. We observed that, there is wide use of small cars in the market. In case of breakdown maintenance or while replacing the tyre, minimum efforts should be required to lift the vehicle.

At present mechanical toggle jacks are being used with lever operated system. With a use of this the required torque to lift the vehicle can be generated with the use of geared motor & reversible switch.

IV. WORKING PRINCIPLE

The button geared worm-gear jack is mostly used for automobiles. Hence we have used the worm and worm gearing to construct the Button operated jack assembly. It consists of four jacks installed on the four wheels. A pair is installed on the rear axle and at the front side there not being the axle we are directly installing one pair on the chassis body.

To operate this jack system jack following procedure is followed.

The jacking mechanism is used in the following way:

A. To Raise The Car Wheel

- This jack can be taken beneath the wheel side which is to be raised using worm geared gear box with chain drive and nut and lead toggle assembly separately.
- Operate the button for the individual wheel position to be raised up the jack lead toggle will come out toward downward side along with the ground rest plate under the jacking point i.e. it may beneath the vehicle or the machine component.
- Rotate the worm shaft using motor power. The worm will rotate the worm gear. The worm gear in turn will rotate the lead nut, which advances through the lead toggle.
- Raise the jacking lead toggle to the upright position to hoist the entire mechanism up the shaft so that the jacking foot (base post) is positioned under the jacking point of the vehicle.
- Here it is not required to adjust the jacking foot position exactly. Once the lead toggle is raised towards down , thereby lifting and firmly locating the foot(base post) under the vehicle jacking point.
- As the required height enough to free rotating point of the wheel is achieved the wheel nuts can be untoggled

- set position need changing, lift the arm and readjust. Once satisfied with the foot's (base post) position, raise lower the lead toggle using lead nut and worm gear advancing and rotating mechanism by motor drive.
- After the work is over rotate the worm shaft to the upright position until the load is lowered down to the wheel on ground resting position.
- We can press all the buttons simultaneously until the vehicle's all the wheel/s are off the ground.

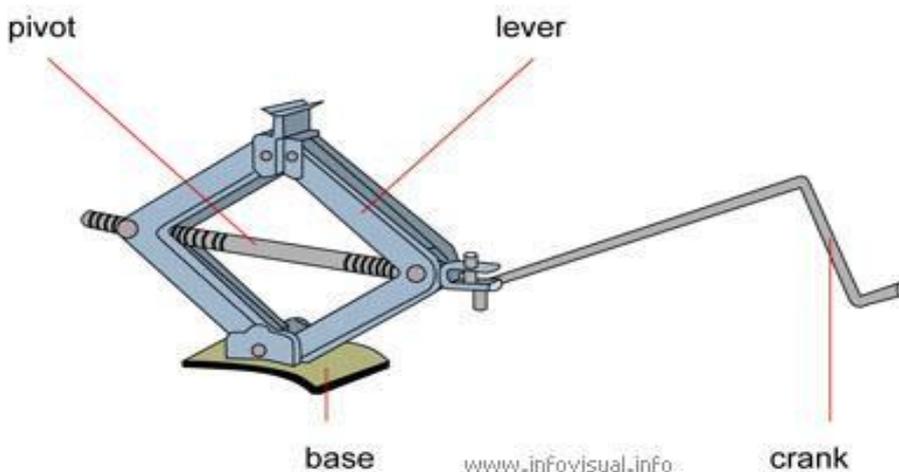
B. TO LOWER DOWN THE JACK....

- Rotate the motor in reverse direction using speed reversal switch raising the jacking lead toggle arm to the upright position.
- rotate the worm shaft coupled motor shaft in anti-clockwise direction.
- Gripping the foot post with hand, raise the lead toggle so as to release the job resting circular plate from the ground towards up. At this point the vehicle's weight is in on the wheel.

V. SPECIFICATIONS

- It is having following specifications:-
- Drive ; worm and worm gear
- Capacity : 500 Kg of concentrated load with concentrated centre of gravity.
- Unit Weight ;- 15 kg
- Maximum Lift ; 300 mm from the ground level.
- Minimum ground clearance required ; 150 mm from the ground.

AUTOMOBILE JACK



VI. MATERIALS

SR NO	COMPONENT	MATERIAL	QTY (No.)
1.	JACK BOTTOM PLATE	M.S.	01
2.	JACK BASE PLATE	M.S.	01
3.	SUPPORT BRACKET	M.S.	02
4.	JACK LINK	M.S.	08
5.	SPACER BETWEEN LINK	M.S.	04
6.	FREE END NUT	En 8	01
7.	SPROCKET SIDE NUT	En 8	01
8.	MAIN LEAD SCREW	En 8	01
9.	LIFTING BASE PLATE	M.S.	01
10.	SPACER	M.S.	01
11.	DRIVEN SPROCKET	En 8	01
12.	DRIVE SPROCKET	En 8	01
13.	MOTOR SUPPORT PLATE	M.S.	01
14.	UPPER HOLDING STRIP	M.S.	01
15.	LOWER HOLDING STRIP	M.S.	01
16.	SIDE HOLDING STRIP	M.S.	01
17.	SUPPORT PLATE	M.S.	01
18.	INCLINED SUPPORT PLATE	M.S.	01
19.	BATTERY SUPPORT	M.S.	02

VII. NOMENCLATURE

A. *Lead toggle* :-It is the component at the top of which a load raising plate is installed or kept on which the concentrated load to be raised, is resting. It manufacture

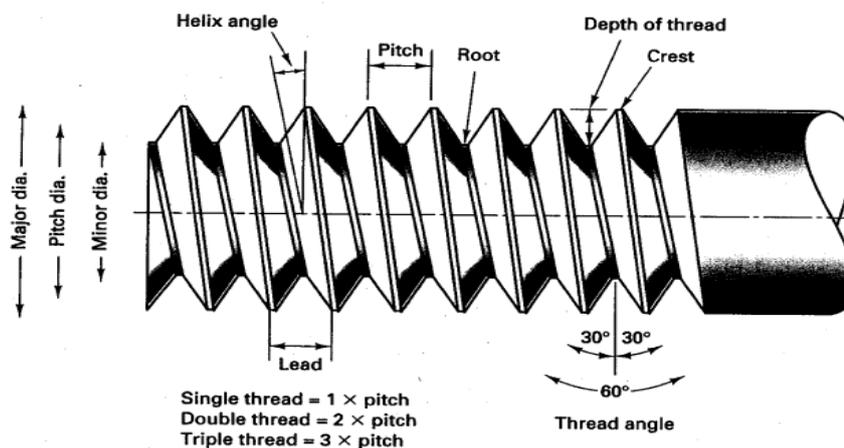
from mild steel material followed by heat treatment of case hardening.

B. *Nut* :-It is the components which is rotated by the worm shaft because the nut is installed on the worm gear. The load raising lead toggle advances through this nut UP

and DOWN. It is applied with the lubricating grease to have it's smooth functioning.

C. *Worm shaft*:-It is that component which actually rotates the worm gear along with the nut to advance the toggle. It is rotated manually using the tomy lever. It perfectly meshes with the worm gear.

Standard screw thread nomenclature



D. *Worm gear wheel*:-It the component being rotated by the worm shaft. it is used to transmit the power between shafts with the perpendicular, non-intersecting axes. It's teeth are similar to involute rack. The worm wheel is essentially a helical gear with a face curved to fit a portion of worm periphery. It is installed with the nut to advance the toggle.

E. *Plate box*:-It is manufactured from the 8 mm thick m.s. plates to form a rigid body of the worm geared jack instead of casting body. It is installed with the worm and worm gearing along with the lead toggle and nut arrangement hold firmly.

F. *Top (Top rest)* :-It is a trapezoidal foot rest over which all the concentrated load of the car and the jack is resting. It forms a robust top to be coupled with the car body or the axle for the complete jack.

G. *Foot platform*:-It is the circular plate which holds the concentrated load firmly without slippage. It may be provided with the serrated area to hold the load firmly.

VIII. APPLICATION OF JACK

A. *Jack and push*

Your vehicle is stuck on soft ground with the axles grounded on a ridge; or you have dropped into a gully and two or more wheels are off the ground and spinning. If the ground is soft, place the jack on its broad base and jack up the vehicle, high enough so that the one set of wheels is higher than the ridge on which the axle has been caught. Now push the vehicle sideways. The vehicle will pivot on the jack and land on the ground with the wheels on the ridge, thereby clearing the axle from the obstacle. In some situations you may need to do the same with the both axles. Vehicles with spare tyres attached to the tailgate may have to either remove them or swing them clear as the falling jack may catch on them and damage the vehicle bodywork. If they are removed from a separate wheel carrying frame, the frame can be closed and used to protect the rear of the vehicle from the jack during this operation.

B. Jack and pack

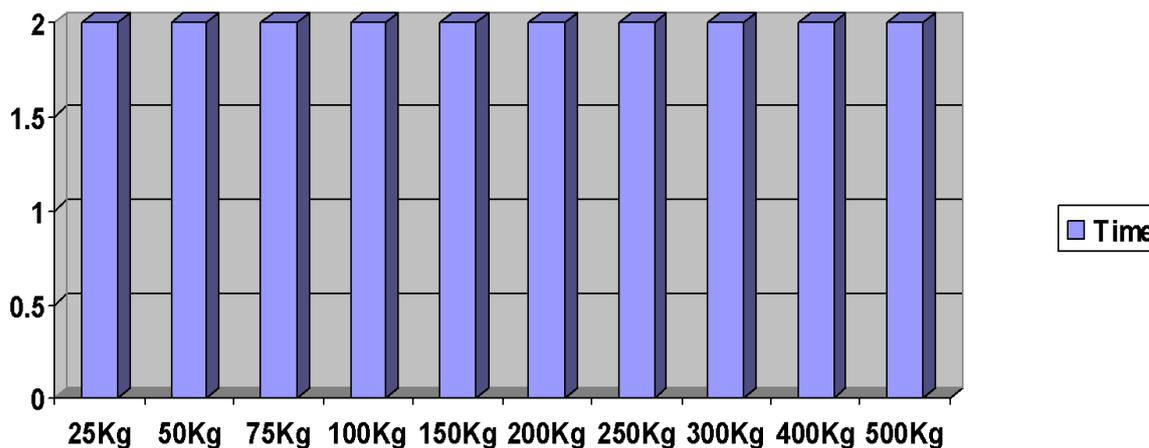
Once this has been done find something to place under them –sand ladders, trac-mats, carpets, rocks, branches or logs - in fact anything lying around (in wet mud, grass seems to make matters worse). Lie items in the direction of travel so that the wheels can gain some momentum as they ride over them. If all four wheels are deeply dug in, this must be done to all wheels. Before attempting to drive out think about the gear ratio to use. Should you use a gear ratio that is too low, the result may be wheel spin, and you may not only undo all your hard work but still have a bogged vehicle. Select the highest gear you think may work - try to remember the gear ratio that was

getting you through difficulties before-hand, because once off the mats or logs you must be able to keep moving without a gear change. Selecting this gear ratio is critical and for each vehicle and for each situation it differs. The vehicle is then lowered and with everyone pushing, the clutch is let out gently with acceleration as smooth as possible. If the wheel spin occurs decelerate gently.

There are cases where a vehicle has bogged down so comprehensively that jacking has been the only way out. Personally I would not venture to a place like the Makgadikgadi Pans in a vehicle not suited to jacking with a high-lift.

IX. RESULT ANALYSIS

Sr. No.	Test Description	Result	Remarks
01	Tested on weight 25Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
02	Tested on weight 50Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
03	Tested on weight 75Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
04	Tested on weight 100Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
05	Tested on weight 150Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
06	Tested on weight 200Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
07	Tested on weight 250Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
08	Tested on weight 300Kg	Failed to lift	Motor used of 0.25HP was insufficient, which changed to 0.50HP
09	Tested on weight 300Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
10	Tested on weight 400Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.
11	Tested on weight 500Kg	Ok lifted upto 150mm height	Lifted in 2 minutes.



Graphical Representation of Result Analysis

X. CONCLUSION

- We started the result analysis with the load of 25 Kg & increased load gradually.
- At every trial the jack lifted the load in the same time span. i.e. within 2 minutes
- When it was tried out at 300Kg, it failed to lift the load. So we concluded that the motor capacity was insufficient to lift the load.
- Then the motor capacity was change from 0.25 HP to 0.5 HP, as the load at single point of wheel is approx. 500kg.
- After changing the motor, it could lift the load of 300kg in 2 minutes. Further load of 400kg & 500Kg was also lifted within 2 minutes.
- Then Jack was rigorously tried out to lift the Car for number of times.

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