# Manually Operated Mechanical Jack

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*Abstract*— This paper describes an overview of the MECHANICAL JACK is one type of lifting device which is used to lift heavy load in Automobile industries for lifting vehicles and different parts of it, as well as in the engineering workshops, etc. We have selected to work on this paper to explain why mechanical jack is better than any other jack. Because we found that some problem were arising while studying on different types of jack such as water leakage in hydraulic jack, Reversible pallet jack cannot be used, in electro mechanical jack when motor fails to start, failure in power supply or in working condition the stoppage of motor may lead to serious accident. To overcome such problems we will prove that mechanical jack is safer and useful operating device than any other jack.

***Keywords:*** Screw shaft, Lifting force, Mechanical Jack, Ratchet

## I. INTRODUCTION

In any small or large scale industries, Garages, workshops, especially in Automobile industries there is need to lift different equipment's, carts, chassis, etc. But they are very heavy and which is impossible to lift without man power and by this it will increase the human effort. And if any accident occurs during lifting, then it is dangerous for workers as well as for industry. [1] It is necessary to lift these costly equipment's, chassis, carts very carefully and safely and it is also required for industries to maintain safety.

In such cases different types of jacks are used.

"A Jack is a mechanical device used as a lifting device to lift heavy loads".

The different types of jacks are listed below: - [4]

- Hydraulic Jack.
- Pneumatic Jack.
- Mechanical Jack.
- Electro Mechanical Jack.

By studying on different types of jack we have decided to work on "Mechanical Jack".

Mechanical Jack is a jack which works manually for lifting cars, chassis, and different components of it.

In this paper we have explained that how this device helps in lifting heavy loads that takes less time to lift the load and also reduces the human effort.

In this paper we have briefly described about the conceptual design and working of Mechanical Jack.

We have explained mechanical jack with its figure, its efficiency, load carrying capacity, its safety, etc. in this paper.

## II. AIM AND OBJECTIVE

Our main objective is to make a "MECHANICAL JACK" which will replace the highly cost hydraulic & pneumatic jacks which are available in market. We would design this jack in such a way that the person operating this device will have very less effort for operating. As we know that jacks are used in automobile vehicles and in some of the small garages for repair work, so to design this jack we will mainly concentrate on difficulties / major problems which were occurring in other jacks. [2]

So to eliminate and reduce some difficulties which were experienced in operating hydraulic & pneumatic jacks we have decided to work on mechanical jack which can be afford by every person as we will also concentrate on cost of product also.

## III. DESIGN WORK

The Front view Top view & 3-D view of Mechanical Jack is shown in Fig. 1, 2, 3 & 4 respectively. [7]

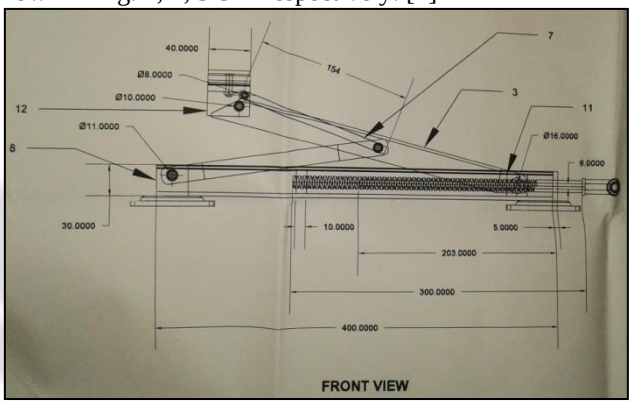


Fig. 1: Front View.

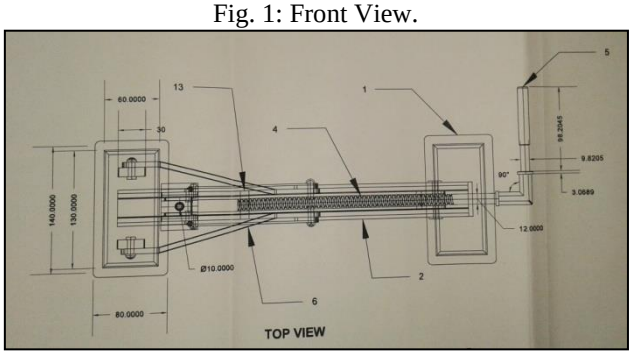


Fig. 2: Top View.

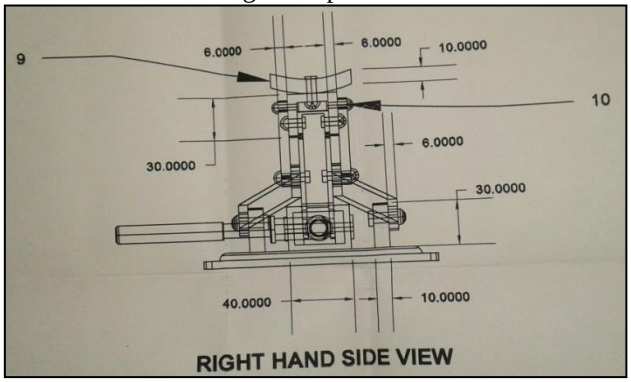


Fig. 3: Side View.

 

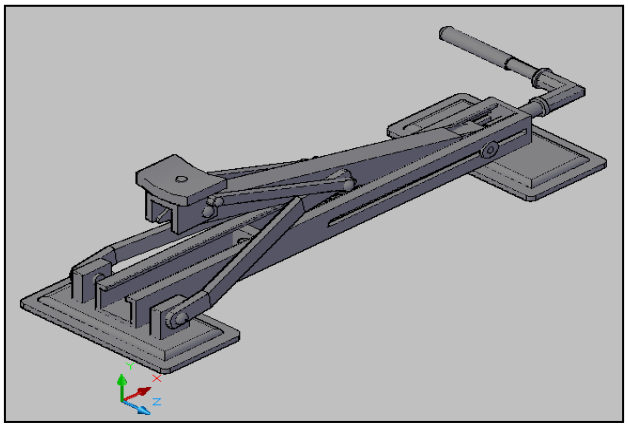

Fig. 4: 3-D View.

## IV. LIST OF COMPONENTS

| SR. NO. | COMPONENTS | QUANTITY |
|---|---|---|
| 1. | Base Plate | 2 |
| 2. | U – Channel | 1 |
| 3. | C – Channel | 1 |
| 4. | Square Threaded Shaft | 1 |
| 5. | Lever (Ratchet) | 1 |
| 6. | Base supporting strip | 2 |
| 7. | Top supporting strip | 2 |
| 8. | Strip supporting member | 2 |
| 9. | Shaft supporting member | 1 |
| 10. | Rivets | 9 |
| 11. | Shaft square nut | 1 |
| 12. | Shaft supporting channel | 1 |
| 13. | Threaded shaft supporting plate | 1 |
| 14. | Plain washers | 2 |

Table 1: List of Components.

## V. WORKING PRINCIPLE

The basic working principle of Manually Operated Mechanical Jack is described below:

The working of this jack is same as that of the screw jack but the only change is in its design, which is been adopted from the Hydraulic Jack. [3], [5]

This jack works on the nut and screw mechanism in which the shaft is rotated with the help of the spanner by rotating the spanner from 0˚ to 180˚.

As the screw is rotated in clockwise direction the nut is moved in forward direction and also the metal supporting strips connected to it is lifted in upward direction and the load the load can be lifted in upward direction.

As we know that the screw is self locking so that the load does not move in downward direction due to the design of square thread and it will also have the support of the supporting strips while coming in downward direction. And we know that square thread is always used where load carrying capacity is large.

When the process is been done in reverse direction that is in Anti – clockwise direction with the help of spanner the load will come in downward position, But note that it is self locking screw so that the load will not fall suddenly on ground.

## VI. METHODOLOGY

Following are the main equations which are used for calculation of Square Threaded Shaft: [8]

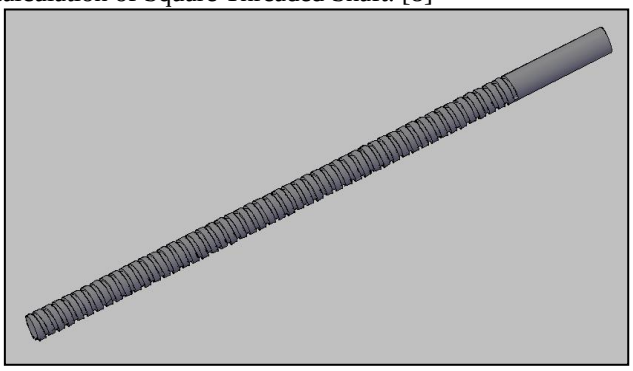

Fig. 5: 3-D View of Square Threaded Shaft.

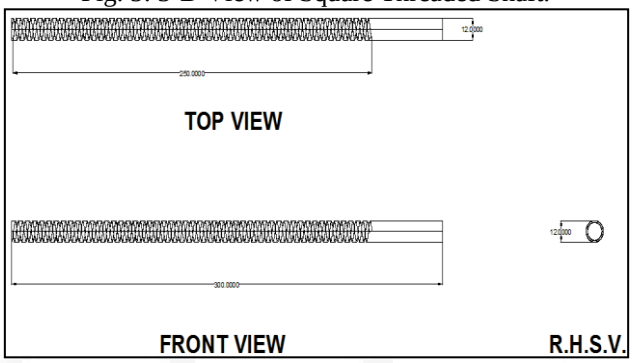


Fig. 6: Basic Views Square Threaded Shaft.

– Efficiency of Square Threaded Screw [8]

Efficiency of Square Threaded Screw (η) = Effort required without friction / Effort required with thread.

$\eta = W \tan\alpha / W \tan(\alpha + ø)$

Therefore, $\eta = \tan\alpha / \tan(\alpha + ø)$ (4.1)

– Overhauling and self-locking [6]

$P = W \times \tan(\alpha - ø)$ (4.2)

Where, α = Helix Angle

Ø = Friction Angle

## VII. RESULT AND DISCUSSION

- We have done full inspection and testing after the model has been assembled. We have also check the alignment of channels with supporting strips, the holes made on channel and strips are acting in a proper way or not.
- The main and important thing is to check that the shaft nut internal threads are mashing with the shaft external threads in a proper way and that was fully successful.
- And finally we have also checked the load carrying capacity of the jack with respect to time taken to carry that particular load.
- It can be clearly understand by the table given below:-

| No of Trials. | Load acting on jack | Time taken to lift load (Minutes) |
|---|---|---|
| 1. | 150 kilograms. | .28 seconds |
| 2. | 280 kilograms. | .32 seconds |
| 3. | 360 kilograms. | .36 seconds |
| 4. | 550 kilograms. | .42 seconds |
| 5. | 800 kilograms. | .52 seconds |
| 6. | 1000 kilograms. = | 1 minute |

| | | |
|---|---|---|
| | 1 Metric Ton | |
| 7. | 1200 kilograms. | 1.08 minutes |

Table 2: Result Obtained After Testing.

– Finally the load carrying capacity of Manually Operated Mechanical Jack is:-

"1200 kilograms in just 1.08 minutes".

## VIII. Conclusion

Finally, we conclude that by working on this concept of MANUALLY OPERATED MECHANICAL JACK it shows us how the different type of jack works and how this Jack works better than other jacks which are available in market. The design of this jack is easy to operate and it reduces the human effort as well.

Now a day's many different types of jacks are available in the market such as hydraulic jack, pneumatic jack etc. which are very costly. So, in small garages and workshops they cannot afford such types of jack. But they can use this type of machine which can be provided to them at low cost and which is having better efficiency to carry load & reliable too for the users.

## IX. Advantages and Application

Following are the advantages of using Manually Operated Mechanical Jack: [7]

– It reduces maintenance cost.
– It reduces effort of labour working in small garage.
– Easy to transport to one place to another.
– Cost of this Jack is less as compared to any other mechanical jack.
– Jack is portable and light in weight.
– It is easily repairable / no difficulty in repair work (Any person can repair).
– No complex design so easy to manufacture such product.
– We can increase load carrying capacity by just changing the design of square threaded shaft.
– Following are the applications of using Manually Operated Mechanical Jack:
– It can be used in small garages and workshops to lift vehicles so that maintenance can be performed or car tyres can be changed easily by any person.
– Can be used as portable jacks in automobile vehicles.

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