Design and Fabrication of Multi Screwjack Using Belt Drive

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***Abstract*— With the increasing levels of technology, the efforts are being put to produce any kind of work that has been continuously decreasing. The efforts required in achieving the desired output can be effectively and economically be decreased by the implementation of better designs. Power screws are used to convert rotary motion into reciprocating motion. An object lifting jack is an example of a power screw in which a small force applied in a horizontal plane is used to raise or lower a large load. In this fabricated model, a belt will be integrated with the object lifting multi jack and thereby the mechanical advantage will be increased.**

Keywords—Screwjack; Driver And Driven Pulley;Belt;Lever

I. INTRODUCTION

Our survey in this regard revealed that in several automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning, repair and maintenance. This fabricated model has mainly concentrated on this difficulty, and hence a suitable device has been designed, such that the vehicle and heavy objects can be lifted from floor land without the application of 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 its essential tools on automobile garages. The object lifting jack has been developed to cater to the needs of small and medium automobile garages, which are normally man powered with minimum skilled labor.

In some of the garages the vehicle and in civil industries the buildings are aligned or lifted by using multi screw jack. This needs high man power and skilled labor.

In order to avoid all such disadvantages, the belt powered multi screw 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 unskilled labor can use it with ease. The pulley is coupled with the lead screw by pulley arrangement; the lead screw rotation depends upon the rotation of rotating screw. This is an era of automation where it is broadly defined as reduction of manual effort by using belt drive.

II. SCREWJACK

Engineers play a key role in the development of our society, contributing towards building the economy and inspiring changes that improve on the quality of life. They possess the ability to comprehend technological processes and creative thinking skills which can help in the solving of the present problems in both business and the industrial world.

Due to global and technological changes in the world today there is a need for research and development activities to help counter this, and this can be in terms of complete or slight changes from the existing technology and all this work requires an engineer.

In an effort to improve the quality of life a power screw was invented, which is also called a translational screw that converts rotary motion into translation motion. Power screws have many applications such as in vices, fastening machines, screw jack and many others. The screw jack is one of the power screws in which a small force is required to be applied to raise or lower a large load

A lifting jack was first designed by Leonardo da Vinci in the late 1400s who demonstrated the use of a screw jack for lifting loads using a threaded worm gear that was supported in bearings and rotated by turning the worm shaft to drive a lifting screw to move the load.

In the early 1880s Frank Henry Sleeper designed a lifting jack which was also based on the principle of ball bearings for supporting a load and transforming rotary motion into translation motion. This design patent was bought by Arthur Osmore Norton leading to the first Norton jacks, which were produced in Boston.

In 1883 a Mississippi river boat captain named Josiah Barrett came up with an idea of the ratchet jack which was based on the familiar lever and fulcrum principle. Duff manufacturing company took up that chance and started the production of Barrett jacks. More recent screw jack designs have concentrated on improved efficiency and durability.

III. PROBLEM STATEMENT

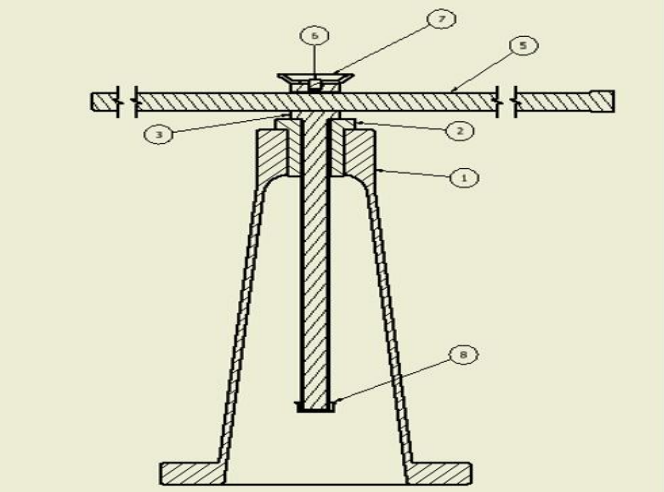
Many authors for example Eng. Nyangasi, Van KudothNaik, Gupta R.S. Khurmi, J.KeithNisbett, and Richard G. Budynas came up with varying procedures for the design of power screws. In order to avoid all such disadvantages, the belt powered multi screw jack has been designed in such a way that it can be used to lift the heavy vehicle or building very smoothly without any impact force. The operation is made simple so that even unskilled labour can use it with ease

IV. OBJECTIVES OF THE STUDY

This project is intended to help future designers of powers screws to easily come up with dimensions of the required power screws by just keying in material properties and the load to be supported to an available program.

- ✓ Select a material with desired properties for the design of a power screw more specifically a screw jack.
- ✓ To come up with a design procedure for the design of a screw jack.
- ✓ To code the procedure above in a language most preferably Mat lab.

V. CONSTRUCTION OF SCREW JACK



A screw jack consists of a screw and a nut. The nut is fixed in a cast iron frame and remains stationary. The rotation of the nut inside the frame is prevented by pressing a set screw against it. The screw is rotated in the nut by means of a handle, which passes through a hole in the head of the screw. The head carries a platform, which supports the load and remains stationary while the screw is being rotated. A washer is fixed to the other end of the screw inside the frame, which prevents the screw from being completely turned out of the nut. Figure below shows a screw jack and its parts and description as labeled.

A. Operation of multi jack

The jack can be raised and lowered with a metal bar that is inserted into the jack. The operator turns the bar with his/her hands in a clockwise direction. This turns the screw inside the jack and makes it go up. The screw lifts the small metal cylinder and platform that are above it. As the jack goes up, whatever is placed above it will raise as well, once the jack makes contact. The bar is turned until the jack is raised to the required level. To lower the jack the bar is turned in the opposite direction.

B .Advantages

The load can be kept in lifted position since the screw jack is self-locking. This means it remains motionless where it was left when the rotational force on the screw is withdrawn. It will not rotate backwards regardless of size of the weight. Screw jacks also lift or raise the moderate heavy weights against gravity and uses very small handle force that can be applied manually.

VI. COMMON TYPES OF SCREW JACK

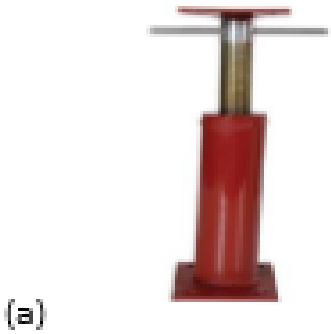


Fig.1: Floor Jack

Fig.2: SCISSOR JACK

VII. FACTORS TO CONSIDER IN SELECTION OF THE BEST JACK FOR APPLICATION PURPOSES

1. Consider the load carrying capacity of the lifting screw (column load) when jacks are loaded in compression. How high do you need to lift the load? One must choose a jack whose lifting screw is stout enough to handle the load at full rise.
2. Consider the travel speed of the dynamic load. The speed at which the load will be moved is a limiting factor. How fast do you need to move the load? Sometimes double lead machine screw jacks or ball screw jacks are a better choice in a given application.
3. How jack need to move the load? Remember that heat builds up between the machine screw and nut during normal operation. Duty cycles for machine screw frequently will the jacks must include periods of rest to dissipate that heat

VIII. MATERIALS SELECTION

Material selection is an important process in design processes. Selecting materials is a process that is design-led in that the material selection process uses the design requirements as the input so as to come up with materials that have the desired properties for the part to be designed to function well.

IX. STEPS FOR SELECTION OF MATERIALS FOR COMPONENTS

Selection of materials in engineering design involves the following steps Translation of design requirements into specifications for a material.

- Screening out those materials that do not meet the specifications in order to leave only the viable candidates.
- Ranking of the surviving materials to identify those that have the greatest potential.
- Using supporting information to finally arrive at the choice of material to be used. The first three steps involve mathematical analysis, use of various charts and graphs of specific property such as specific strength, wear resistance, buckling resistance and affordability. The materials are compared, ranked as per the indices of merit and available supporting information is used to reach the final decision

In this project, information from case studies on previous designs of similar products is used in material selection for the screw jack components/parts. However, other factors such as availability of the candidate materials, purchase price of the candidate materials, manufacturing processes and properties, forms and sizes in which the materials are available are also considered.

X. THREAD SERIES

There are three standard thread series in the unified screw thread system;

1. Fine series
2. Coarse series
3. Normal series

Fine series has advantages over the other series, these are;

- ✓ They have large stress areas hence are strong in compression
- ✓ They have a larger minor diameter which develops higher tensional and shear strength.
- ✓ They have smaller helix angle therefore permitting closer adjustment accuracy

XI. THE FOLLOWING CONCLUSIONS CAN BE DRAWN ON THE BASIS OF THE DEVELOPMENT OF THREAD:

- ✓ The screw can be considered as an inclined plane with α as the angle of inclination.
- ✓ The load W always acts in the vertical downward direction. When the load W is raised, it moves up the inclined plane. When the load W is lowered, it moves down the inclined plane.
- ✓ The load W is raised or lowered by means of an imaginary force P acting at the mean radius of the screw. The force P multiplied by the mean radius ($dm/2$) gives the torque T required to raise or lower the load. Force P is perpendicular to load W.

XII. CONSTRUCTION OF A MULTI JACK

A multi screw jack consists of a screw and a nut. The nut is fixed in a cast iron frame and remains stationary. The rotation of the nut inside the frame is prevented by pressing a set screw against it. The screw is rotated in the nut by means of a handle, which passes through a hole in the head of the screw. The head carries a platform, which supports the load and remains stationary while the screw is being rotated. A washer is fixed to the other end of the screw inside the frame, which prevents the screw from being completely turned out of the nut. In the nut part driver pulley is attached. So another jack is connected with the help of belt drive. Thus multi jack is lifted with the help of single nut part.

Fig.3. multi operated screw jack using belt drive

XIII. CONCLUSION

We concentrated on design of a simple mechanical screw jack where the nut is fixed in a cast iron frame and remains stationary while the spindle is being rotated by the lever. This design can only work for light loads hence when a screw jack is needed for heavy load application a different design is required where the nut is rotated as the spindles moves .We therefore recommend design of A belt drive screw jack for the heavy loads. We can say without any doubt, that it gives the promising future and opens the gateway for Civil and Automobile Industry

XIV. REFERENCES

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