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OPEN END PNEUMATIC OPERATED WRENCH

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Abstract - *The aim of this project is to design and fabrication of open end pneumatic operated wrench for tightening and loosening of nut and bolt head which is located in a congested area where there is inadequate space to pivot or rotate handle of the wrench. Nowadays everybody wants to save time and effort by inventing some newer technique or mechanism and implement them in their daily life. We have developed a gear planetary mechanism to reduce the time and effort for the above mentioned task. In our project we have tried to focus on the minimization of human effort and time consumed for tightening and loosening of nut and bolt. Rotation of the extension bar with a ratchet, a breaker bar, strong arm or a power tool such as pneumatic or electric impact wrench, or drill motor provides perpendicular torque to drive the gear head socket rotating the teeth turning the nut or bolt.*

Key Words: **nut and bolt, congested, wrench, gear, pneumatic.**

1 INTRODUCTION

Today's world is of the fast and rapid process. Everybody wants to save time and effort by inventing some newer technique or mechanism and implement them in the daily life. The main objective of the project is to reducing the human effort and also by reducing the time consumption on tightening and loosening of nut and bolt in the congested location of submersible pump head. This wrench is designed for using in M10 bolts and nut. The size of the wrench can be varied by replacing the gear head according to the desired size of bolt and nuts.

1.1 LITERATURE SURVEY

The different types of wrench used for various purpose using various mechanism are discussed in the below papers.

Gopal Kupta,[1] described wheel cap nuts must be kept tight. Reduced and inconsistent wheel clamping condition can cause wheels to loosen and disengage from the vehicle, causing serious injury or death. The Effective Mechanical Wrench(EMW) is a newly designed wheel wrench for easy loosen truck, bus tyres lug nut or car tyres by using less labor to reach a sufficient output torque without impact.

NiteshL.Gomase [2] tells this project aims to design and fabrication of four wheeler multiple-opening wrench for tightening and removing of the four nuts in a single stroke of a hand operated lever. In our project we have tried to focus on the minimization of human effort and time consumed for fixing all four nuts of the ø100mm PCD tire with a single stroke of lever.

Ching-An Chiang[3] described single-direction operable open-end wrench includes a handle having an open end delimited by opposite jaws. One of the jaws forms a cavity delimited by a curved internal wall to receive a movable jaw block

Cody Kiser[4] discussed non-ratcheting socket tool for loosening or tightening nuts or bolts, especially when the nut or bolt head is located in a crowded area where there is inadequate space to pivot or rotate a handle of a wrench or ratchet.

David Ling[5] tells ratchet type bending wrench comprises a handle; a holding portion at one end of the handle; a bending tubular portion at another end of the handle; an engaging unit having a part rotatable installed in the bending tubular portion; and the other part of the engaging unit being protruded from the bending tubular portion for engaging With a sleeve

1.2 DETAILED DESIGN

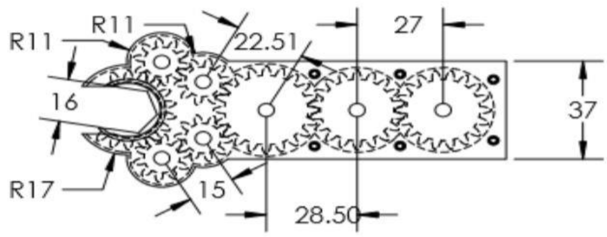

Fig.1: Internal arrangement of gears

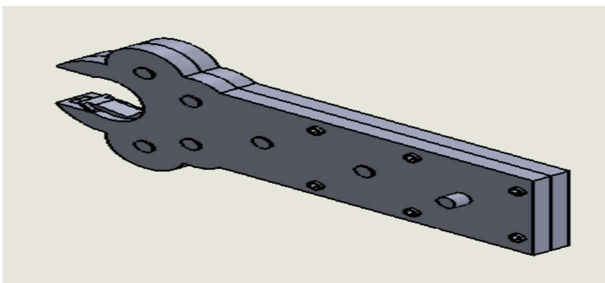

Fig.2: Isometric view of wrench

1.3 COMPONENTS

- Spur Gear (Ø30mm)
- Spur Gear (Ø33mm)
- Spur Gear (Ø18mm)
- Motor (1/2HP)
- Shaft (Ø10mm)
- Shaft (Ø12mm)
- Allen Screw(M3 size)

2. DESIGN CALCULATION

The maximum torque required for loosening and tightening the M10 bolt is

POWER REQURIED,P=Tω

$$\omega=\frac{2\times\pi\times N}{60}$$

$$P=\frac{24\times2\pi\times180}{60}$$

P=427.25 Watts

= 0.60 HP

P =1/2 HP (standard motor specification)

2.1 STANDARD MOTOR SPECIFICATION

POWER, P =1/2 HP

SPEED, N=180 rpm

TORQUE, T=P/ω

$$T=\frac{60\times P}{2\pi\times N}$$

$$T=\frac{60\times427.25}{2\pi\times180}$$

=22 Nm

2.2 GEAR RATIO CALCULATION

STAGE 1:GEAR Ratio

$$i=\frac{Number\ of\ teeth\ on\ driver(T1)}{Number\ of\ teeth\ on\ driven(T2)}=\frac{Speed\ of\ driven\ gear(N2)}{Speed\ of\ driver\ gear\ (N1)}$$

$$i=\frac{N1}{N2}=\frac{T2}{T1}=\frac{180}{N2}=\frac{18}{18}$$

N2=180 rpm

STAGE 2: $i=\frac{N2}{N3}=\frac{T3}{T2}=\frac{180}{N3}=\frac{20}{18}$

N3=162 rpm

STAGE 3: $i=\frac{N3}{N4}=\frac{T4}{T3}=\frac{162}{N4}=\frac{10}{20}$

N4=324 rpm

STAGE 4: $i=\frac{N4}{N5}=\frac{T5}{T4}=\frac{324}{N5}=\frac{10}{10}$

N5=324 rpm

STAGE 5: $i=\frac{N5}{N6}=\frac{T6}{T5}=\frac{324}{N6}=\frac{10}{10}$

N6=324 rpm

STAGE 6: $i=\frac{N6}{N7}=\frac{T7}{T6}=\frac{324}{N7}=\frac{10}{10}$

N7=324 rpm

STAGE 7: $i=\frac{N7}{N8}=\frac{T8}{T7}=\frac{324}{N7}=\frac{18}{10}$

N7=180 rpm

2.3 OUTPUT TORQUE

POWER REQURIED,P=Tω

TORQUE, T=P/ω

$$\omega=\frac{2\times\pi\times N}{60}$$

$$T=\frac{60\times P}{2\pi\times N}$$

$$T=\frac{60\times430}{2\pi\times180}=22\ Nm$$

3 COST ESTIMATION

S.NO	COMPONENT NAME	MATERIAL	COST
1	1.5 Module Spur Gear (18 Teeth)	Mild Steel	70/Kg
2	1.5 Module Spur Gear (20 Teeth)	Mild Steel	70/Kg
3	1.5 Module Pinion (10 Teeth)	Mild Steel	70/Kg
4	Shaft	Mild Steel	70/Kg
5	Outer Casing	Mild Steel	70/Kg
6	Alan Screw	Mild Steel	70/Kg

Table 1: cost estimation

4. EXPERIMENTAL RESULTS

The maximum torque developed by this wrench is about 21Nm. This wrench can be used for light load purpose. For higher load purpose, modifying the gear specification such as module, pitch diameter, base diameter etc. can yield better results.

5. CONCLUSIONS

This wrench is suitable for tightening and removing of the nuts and bolts which is located in a crowded area where there is inadequate space to pivot or rotate a handle of the wrench. Also minimization of human effort and time consumed for tightening and removing of the nuts and bolts. This wrench is made only for M10 bolt, if change the size of the nut we should make gear head for required size.

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BIOGRAPHIES

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