Consideration of Material changes in Enhancement to get Unique Solutions in Screw Jack-Screw

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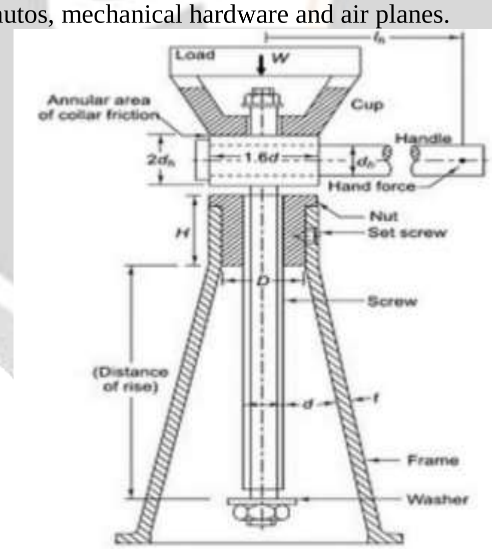
ABSTRACT

A power screw is drive utilized hardware to change over a revolving movement into a straight movement for power transmission. It produces uniform movement and the. Outline of the power screw might be with the end goal that either the screw or the nut is held at rest and the other member rotates as it moves axially. By analyzing different parameters in design of different threaded screw is done to get the most suitable combination of thread profile and there efficiency is calculated by different nominal diameters and pitch values to get unique solutions by changes the materials for screw.

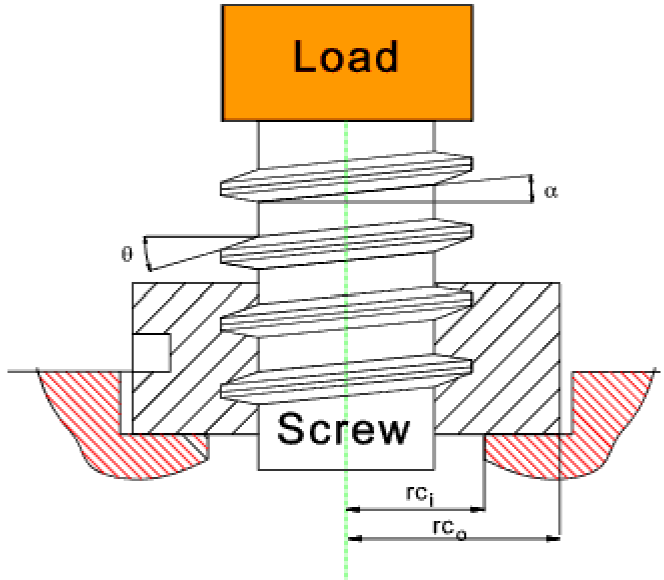
Keywords: *Thread Profile, Co-efficient of friction, helix angle, Efficiency.*

I. INTRODUCTION

A screw jack is a reduced contraption involving a screw part used to raise or lower the heavy loads. There are two main applications of screw jack to be particular water fueled and mechanical screw jack. . A hydraulic jack consists of a cylinder and piston mechanism. Mechanical jack can be either hand operated or power driven. Screw jacks are made of various kinds of material having distinctive thread profiles square, trapezoidal, acme, buttress, etc. screw jack much of the time utilized as a part of raising autos, mechanical hardware and air planes.



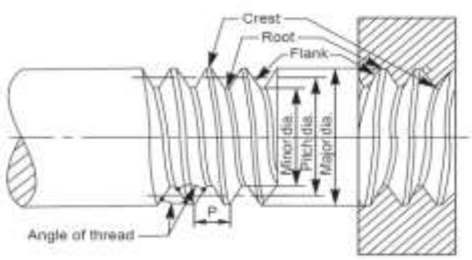
Screw jack



Screw

Nomenclature of Thread:

A screw thread is obtained by cutting a continuous helical groove on a cylindrical surface (external thread). The threaded portion engages with a relating strung opening (inner string); framing a screwed clasp. Taking after are the terms that are related with screw threads Screw thread nomenclature



Nomenclature of Thread

1. Major (nominal) diameter: This is the greatest separation crosswise over of a screw string, touching the tops on an outside string or the fundamental establishments of an inside Thread.

2. Minor (center) measurement: This is the littlest width of a screw string, touching the roots or center of an outer string (root or center distance across) or the peaks of an inward string.

3. Pitch distance across: This is the breadth of a nonexistent chamber, going through the strings at the focuses where the string width is equivalent to the space between strings

4. Pitch: It is the separation measured parallel to the hub, between relating focuses on adjoining screw threads.

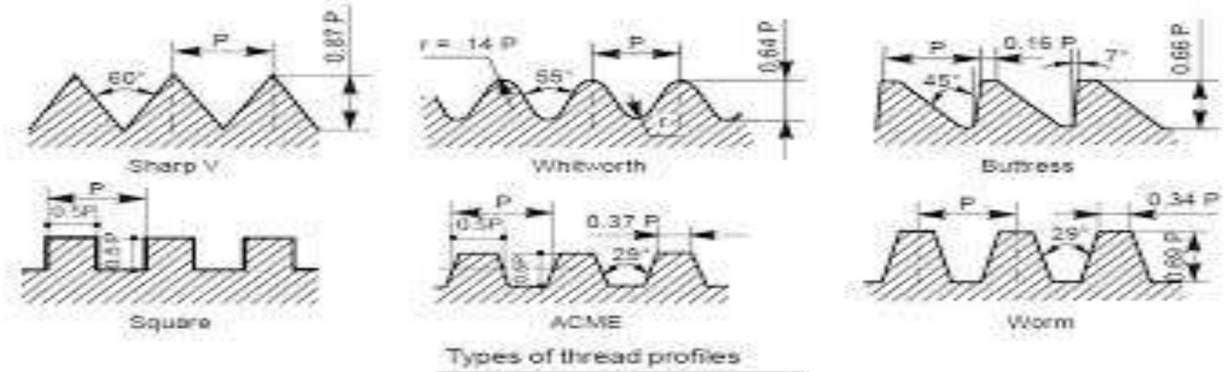
5. Lead: It is the separation a fasten progresses pivotally one turn.

6. Flank: Flank is the straight piece of the surface, on either side of the screw Thread.

7. Peak: It is the pinnacle edge of a screw string, which associates the contiguous flanks at the top.

8. Root: It is the base edge of the string that associates the contiguous flanks at the base.

9. String point: This is the edge included between the flanks of the string, measured in a hub plane.



Types of Thread Profiles

II. DESIGN OF SCREW

The screw is subjected to pure compression and hence its core diameter is calculated = d_c=d-p
The mean diameter of the screw is given by d_m= (d-0.5p)

Helix angle =$\tan\alpha = l/\pi * dm$
For single –threaded screw the lead is same as the pitch .for double threaded screw; the lead is twice of the pitch, and so on

For square threaded $\tan\Phi = \mu$
For trapezoidal = $\mu\sec\Phi=\mu/\cos 15$
For acme threads= $\mu\sec\Phi=\mu/\cos 14.5$

Also When $\Phi > \alpha$, screw is self locking.
For square
Torque required to raise the load
$Mt = W*(dm/2) * \tan(\Phi+\alpha)$

Torque required to lower the load,
$Mt = W*(dm/2) * \tan(\Phi-\alpha)$

$\eta_{screw} = pi/p = \tan\alpha/\tan(\Phi+\alpha)$

For trapezoidal&acme
Torque required to raise the load

$Mt = W*(dm/2) * (\mu\sec\Phi + \tan\alpha)/1 - \mu\sec\Phi\tan\alpha$
Torque required to lower the load,

$Mt = W*(dm/2) * (\mu\sec\Phi - \tan\alpha)/1 + \mu\sec\Phi\tan\alpha$
$\eta_{screw} = \tan\alpha(1-\mu\sec\Phi\tan\alpha)/ \mu\sec\Phi + \tan\alpha$

III.RESULTS & DISCUSSION

In power transmission a square thread profiles are basically utilized. They assume critical part as effectiveness of screw is related with kind of thread profile and coefficient of rubbing. For power screw especially for screw jack unmistakable sorts of square thread profiles are open like square, trapezoidal, summit and support and changed square. In the present work, a screw jack is plan logically. In this jack, screw and nut are most noteworthy segments A fix is organized light of most over the top pliant anxiety and most important shear push. For most extreme load it is important to guard both values inside point of confinement for outline. Nut is a stationary part in which a screw turns. In this way a course weight is likewise considered. For both the parts, in case we take blend of different materials for each join of screw and nut so we can find better possible results to get sensible plan. The standard material blends are (1) Hardened Steel-Bronze, μ= 0.08 (2) Soft Steel-Bronze, μ= 0.10 (3) Hardened Steel-Cast Iron, μ= 0.15 (4) Soft Steel-Cast Iron, μ= 0.17

IV. CALCULATED VALUES OF PARAMETERS FOR DIFFERENT SCREW COMBINATIONS

In the design of screw thread, a square thread profile is considered for screw . However, the standard pitches (5 to 12mm) & standard nominal diameters (24 to 100mm) are taken in order to calculate efficiency of different types of thread profiles. Moreover for screw-nut material combination standard values of coefficient of friction are taken as a reference parameter:

In this design a screw is a primary element (i.e. the most critical part) while a nut is a secondary element. So the stresses developed on these elements are calculated. Moreover, torque transmission and critical load on screw are also found. Eventually, the calculated values and standard values are compared to find out better material for each component

Table 1 - Efficiency of different thread profiles
For μ= 0.08 (Hardened Steel-Bronze)

Pitch (mm)	Nominal diameter (mm)	Square thread η(%)	Trapezoidal thread η(%)	Acme thread η(%)
5	24	48.061	47	47
	28	43.825	43	43
6	32	45.149	44.05	44.05
	36	41.85	41	41
7	40	43.28	42.217	42.217
	44	40.75	40.3	40.3
8	48	42.03	41.3	41.3
	52	40.4	39.9	39.9
9	55	41.61	40.52	40.52
	60	39.22	38.35	38.35
10	70	37.97	36.95	36.95
	80	34.662	33.71	33.71
12	90	36.25	35.27	35.27
	100	33.88	32.95	32.95

Table 2 - Efficiency of different thread profiles
Soft Steel-Bronze, μ= 0.10

Pitch (mm)	Nominal diameter (mm)	Square thread η(%)	Trapezoidal thread η(%)	Acme thread η(%)
5	24	42.537	42.211	42.211
	28	38.43	37.37	37.37
6	32	39.70	38.61	38.61
	36	36.65	35.69	35.69
7	40	37.90	36.71	36.71
	44	35.49	34.55	34.55
8	48	36.708	35.81	35.81
	52	34.641	33.72	33.72
9	55	36.30	35.88	35.88
	60	34.045	33.71	33.71
10	70	32.87	31.9	31.9
	80	29.79	29	29
12	90	31.27	30.74	30.74
	100	29.07	29	29

Table 3 - Efficiency of different thread profiles
Hardened Steel-Cast Iron, μ= 0.15

Pitch (mm)	Nominal diameter (mm)	Square thread η(%)	Trapezoidal thread η(%)	Acme thread η(%)
5	24	32.66	31.94	31.94
	28	34.57	33.62	33.62
6	32	30.244	29.77	29.77
	36	26.64	25.72	25.72
7	40	28.64	27.66	27.66
	44	26.63	25.71	25.71
8	48	27.644	26.82	26.82
	52	25.90	24.95	24.95
9	55	27.308	26.65	26.65
	60	25.55	24.66	24.66
10	70	24.44	23.84	23.84
	80	21.91	20.63	20.63
12	90	23.116	22.74	22.74
	100	21.33	20.67	20.67

Table 4 - Efficiency of different thread profiles
Soft Steel-Cast Iron, μ= 0.17

Pitch (mm)	Nominal diameter (mm)	Square thread η(%)	Trapezoidal thread η(%)	Acme thread η(%)
5	24	29.97	28.74	28.74
	28	26.61	25.63	25.63
6	32	27.57	26.81	26.81
	36	25.126	24.66	24.66
7	40	26.13	25.78	25.78
	44	24.23	23.90	23.90
8	48	25.18	24.52	24.52
	52	23.55	22.74	22.74
9	55	24.86	23.63	23.63
	60	23.23	22.83	22.83
10	70	22.18	21.61	21.61
	80	19.83	19.01	19.01
12	90	20.95	20.11	20.11
	100	19.288	18.90	18.90

Efficiency v/s Pitch μ= 0.08 (Hardened Steel-Bronze)

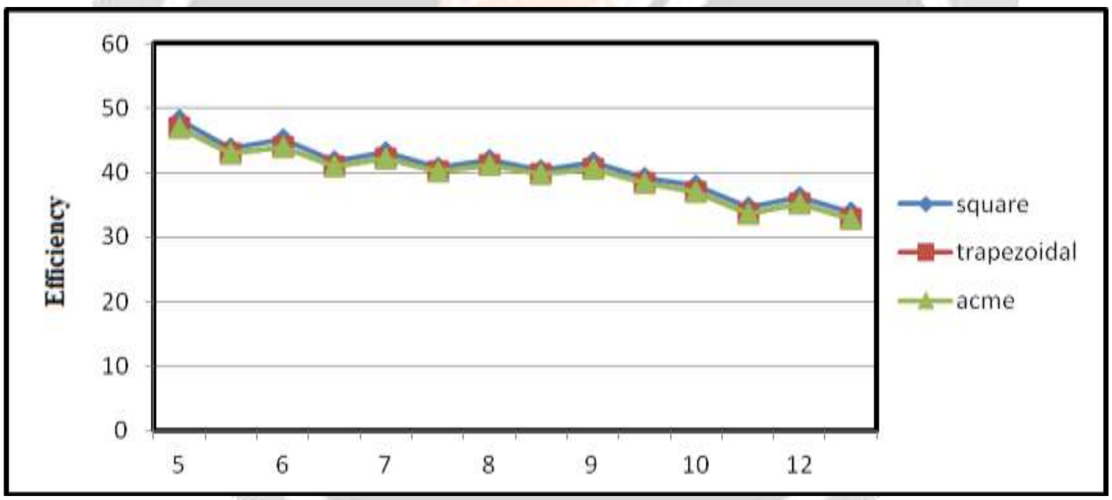


Chart 1- Efficiency v/s Pitch for standard thread profiles

Efficiency v/s Pitch Soft Steel-Bronze, μ= 0.10

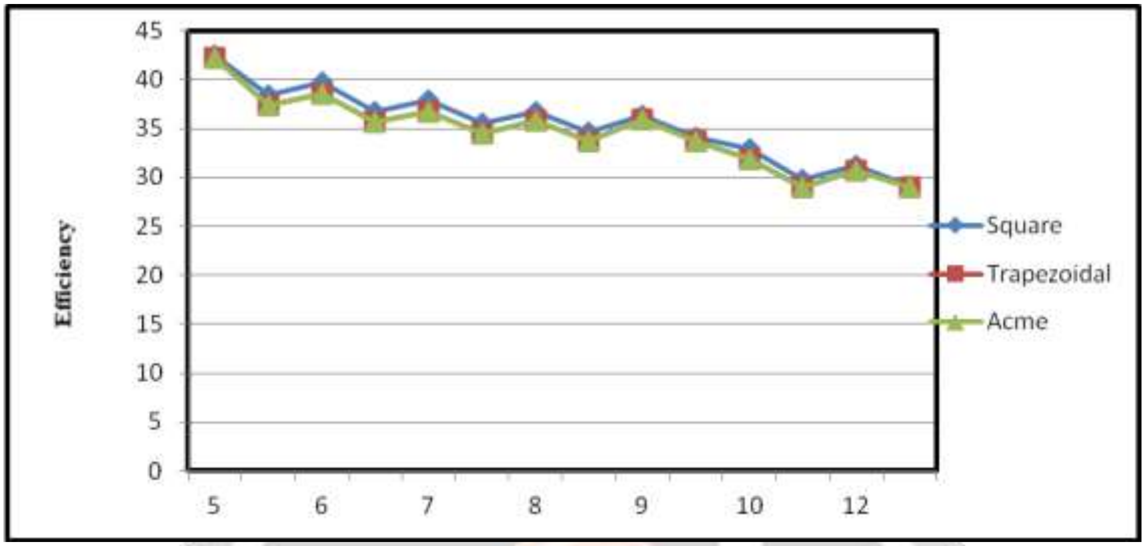


Chart 2- Efficiency v/s Pitch for standard thread profiles

Efficiency of different thread profiles Hardened Steel-Cast Iron, μ= 0.15

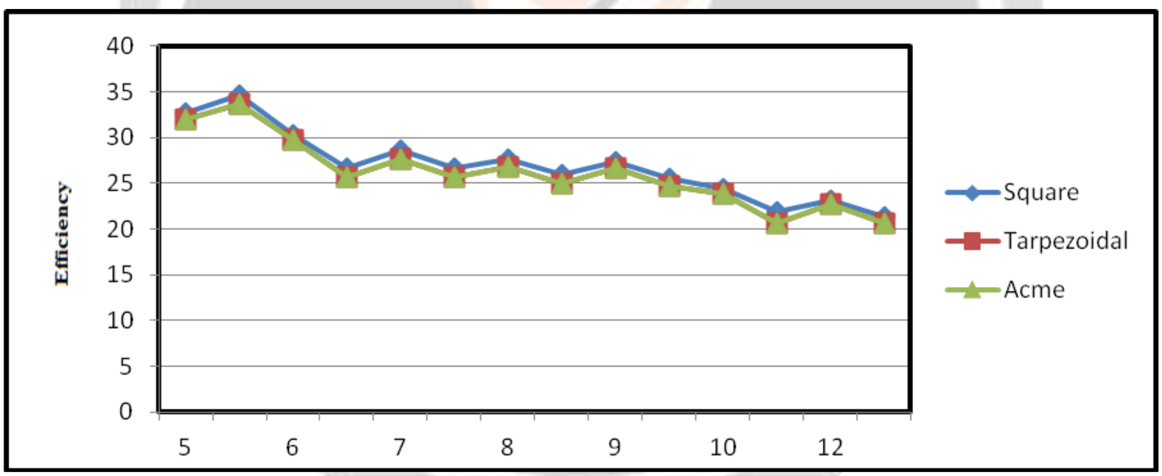


Chart 3- Efficiency v/s Pitch for standard thread profiles

Efficiency of different thread profiles Soft Steel-Cast Iron, μ= 0.17

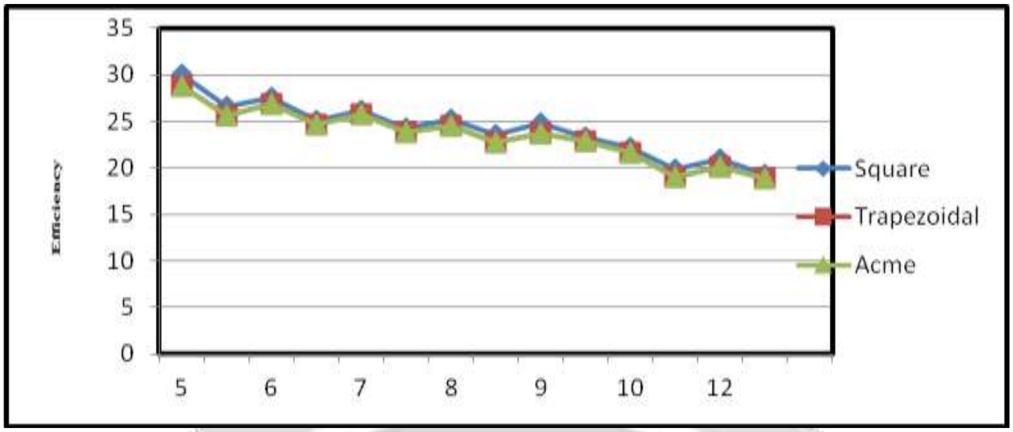


Chart 4- Efficiency v/s Pitch for standard thread profiles

V.CONCLUSION

In this work an effective endeavor is made to outline a screw jack-screw. The outline is finished by shifting distinctive parameters like string profile, screw material blend, pitch and width. The entire plan concentrates on how the estimations of effectiveness, fluctuates with coefficient of contact and pitch. Here, the fundamental idea is built up for picking the best material blend and string profile for given. By this we reasons that Material changes in Upgrade to get Unique Solution in Screw Jack-Screw

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