Automation of Parkison's Gear Tester

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ABSTRACT. Constant change is observed in manufacturing sector in accordance with the trouble of passing on new arrangement into reality. New machines and the frameworks are being made constantly to makes diverse thing at less costly rates and with high precision. Gear is most important component in to the power transmission method. The gear profile is very is important factor of gear application at different area like automobiles, machine tools & other area power transmission. Hence the gear shape & accuracy is very important. Parkinson gear tester excellent testing measuring instrument for gears. Model of Parkinson gear tester testing includes the gear tooth profile through dial indicator. It can be very useful for gear testing laboratories, gear modification industries and gear repairing workshops.

Keywords- *spur gear, gear test rig,gear profile, gear modification*

I. INTRODUCTION

Today's world requires speed in each and every field. Hence, rapidness and quick working is most important. Now days for achieving rapidness, various machines and equipments are manufactured by man.[4] The engineer is constantly conformed to the challenges of bringing ideas and design in to reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. The "PARKINSON GEAR TESTER" is being compact and portable equipment, which is skillful and is having something precise in testing the gears being manufactured. Most of the material is made available in market. [6]The parts can be easily made in work-shop. Its price is also less. Parkinson gear tester is useful to improve the quality of the gear being manufactured and can be made in less time. [4]

II. LITERATURE REVIEW

Jain et al [1], have presented Parkinson gear tester as an efficient tool for checking the flank surfaces of the gear and determine the error significantly. For efficient performance of the gear, they have performed three levels of test experiments considering flank surface. It was observed that this test rig can improve the life of gear. Shinde et al [4], have presented Parkinson gear tester to be extending gear life and reducing error. Their work aims to understand the accuracy of flank surfaces. They have presented that the various test rig which is used for measurement of particular parameter like gear tooth alignment, gear tooth surface and pitch circle these are to be tested. This test rig differs as per the requirement of application and as per requirement of parameter to be tested. Nannaware et al [5] , have presented Modified Parkinson gear tester. In order to check the combined tooth errors, different types of gear testing machines were used. Various machines have its ability to check specific parameters only. They used springs and slider table with roller these will provide flexibility of checking composite error of different types of gears. This concludes that modified test rig can check composite error with higher accuracy. This gear test rig will check the gear in minimum time which results in decrease of Productive time & improve efficiency of inspection. Devkate et al [6], have presented that Parkinson gear test rig is the easiest to use equipment for checking any irregularity in gear tooth. In Parkinson test rig, three rectangular plates is used which is mounted on linier guide ways. In working condition of test rig, the movements of the plate will response the error in gear. It was observed that the locking and jamming of gears can be easily detected from this technique. Agashe et al [10], have presented that Parkinson gear tester is most suitable equipment which can be used to measure deflection of gears. In this they use plastic gears in order to reduce material cost and also by using manually adjustable spring load errors could be defined. They conclude that in case of dry condition of gear mating part friction is more which gives more deflection.

III. PROBLEM STATEMENT

In conventional gear test rig, there is a scope for checking the composite error of any one kind of gear so that for checking different type of gears in manufacturing process it required to have different test rigs, also accuracy of checking composite error must have to increase. This problem gives out a way to develop modified gear test rig in form of Parkinson's gear tester.

IV. PROPOSED DIAGRAM

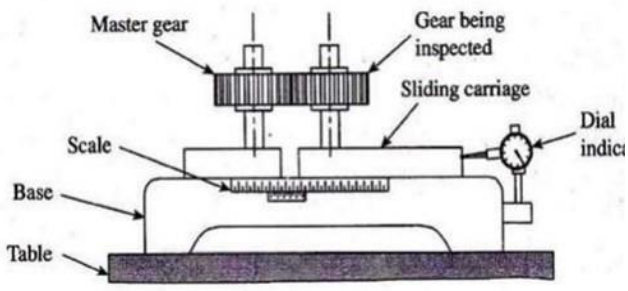

Fig. 1: Experimental setup of Parkinson's Gear Tester [1]

V. WORKING

To operate the testing machine, electric motor, which is torque motor having 5 kg-m torque capacities is used to rotate the master gear against the gear to be tested. Also, another motor of the same capacity is used to rotate the paper rolling drum to pass the recording paper against the vibrating pen and stylus due to the improper tooth geometry provided. The gear to be tested is installed on the trolley gear shaft using the fasteners as the nut and bolts. The spring loaded trolley is in uninterrupted close interaction with the master gear. Coupling is used to couple the extended shaft of the master gear as well as the driving D.C motor. When a couple of master gear and the gear to be tested is rotating and if there is some uneven run of the gear to be tested then the stylus and pen arrangement will deflect and the suitable quantity of variation in the graph which is recorded on the moving paper. Thus the working of Parkinson's gear test rig equipment is done.

VI. COMPONENT DISCRIPTION

The Parkinson's gear tester consists of following parts: *a)*Motor

b) Test specimen gear
c) Master gear
d) Dial gauge
e) Spring
f) Floating carriage
g) Base

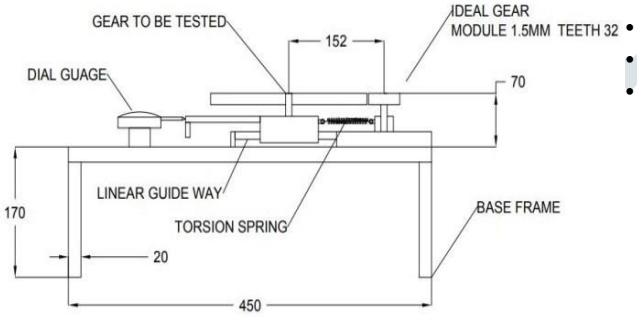

Fig. 2: Line diagram of Parkinson's Gear Tester [5]

a)Motor

1. Specifications: Speed (N)= 800 rpm
Voltage = 12 V
Current = 30 A

The motor shaft is made of mild steel and its allowable shear stress, τ= 42 MPa [3]

Power= 360 W 2.

Calculation:

To find motor torque,

$$P = \frac{2\pi NT}{60} \quad [3]$$

$$= \frac{2\pi \times 800 \times T}{60}$$

T= 430 N-M

For the diameter of motor shaft,

$$\frac{T}{\frac{\pi}{32} \times d} = \frac{\tau}{R} \quad [3]$$

D= 8 mm

b)Master Gear

Master gears are made with sufficient accuracy capable of being used as the basis for comparing the accuracy of other gears. These are frequently used in composite error determination in these the master gears are rotated in close contact or single contact with the gears under testing. The master gear should preferably have lower module value because with coarse the master gear would have either a very few teeth or else it will be relatively big, making it hard to handle beside high manufacturing cost.

Here we have selected the material as per the following. According to design of shaft the master gear is selected having following data which suitable to shaft design.[3]

- Material of master gear is 40C8 i.e. plain carbon steel.
- Ultimate tensile strength, S_{ut} = 420 N/mm^2
- Standard module, m = 5
- Outer diameter of master gear, d_o = 100
- Number of teeth on gear, Z_g = 20
- Face width, b = 10m = 50 mm
- Factor of safety = 3
- Tooth system is 20^0 full depth involute
- Addendum, h_a = 1m = 5 mm
- Dedendum, h_f= 1.25m = 6.25 mm
- Circular pitch, P_c = 15.7 mm

c)Dial Gauge

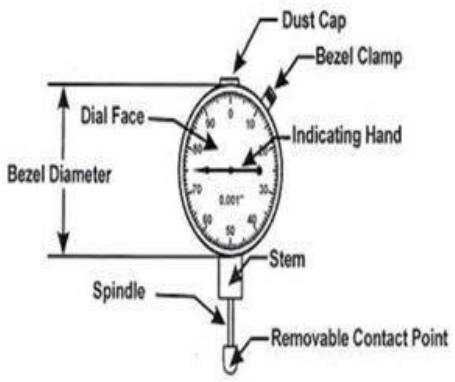

Fig 3: Specifications of dial gauge[5]

d)Spring

A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. Depending on the design and required operation environment, any material can be used to construct a spring. This spring is use to support the overhang magnification linkage arrangement. The spring is subjected to tensile load, so spring is design for tensile failure. Spring required to with stand the pull of 0.5 kgf (max) = axial thrust. [3]

i. Specifications:

W= 0.5 kgf

G = 0.84 x 10^6 kg / cm².

Number of springs = 2

Fs = 4200 kg / cm² for spring steel

To find the diameter of spring wire,

$$T = w \times \frac{D}{2} \quad [3]$$

$$12 = 0.5 \times \frac{d}{2}$$

d = 0.6 mm

Hence we have taken the spring wire of diameter as 0.6 mm. The length of spring is taken as per requirement, which is taken as 65 mm

VII. NOMENCLATURE

Table No. 1: Nomenclature

Description	Symbol
Speed	N
Volt	V
Ampere	A
Allowable shear stress	σ
Power	P
Torque	T
Ultimate tensile strength	Sut
Module	m
Outer diameter of master gear	do
Number of teeth on master gear	Zg
Factor of Safety	FOS
Addendum	ha
Dedendum	hf

VIII. FUTURE SCOPE

Since ancient times, men have tried to gain more and more luxury. Hence, there has always been a scope for modification in manufacturing. The following future modifications can be implemented: The motor and roller and paper holding channel platform can be made swiveling type by installing the platform by the cross rods and bearing arrangement rolling on the grooved path on the circular fixed plate and using spring tension. Thus it can be used to take gear geometry in circular scale also. The swiveling platform can be made to rotate slowly by installing the gear box installed with the motor or using high torque stepper motor. Instead of the constant speed it can be operated for multi speed and can be made microprocessor based testing unit. The place where there is scarcity of the electricity, the electric motor is replaced by an I.C. Engine. We can install the special indexing mechanism on the work piece table to rotate a particular job through a particular angle.

IX. CONCLUSION

The prototype of test rig offers very appropriate and improvidently viable means of creating the actual working condition for the gears to be tested. The test rig design is totally depends on requirement of testing parameters and errors which we want to check. Due to the use of the gear test rig, functional inspection of the gear can be carried out which is very desirable in manufacturing use.

X. ACKNOWLEGEMENT

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