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Test Rig on Parkinson Gear Tester

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Abstract: "Test rig on Parkinson gear tester" is a very great innovation in its own & is specially made for the purpose of checking flank surfaces of gear. Gears are the crucial element of any transmission system which generally used for power transmission. Such type of part must be check by using the highly accurate methodology in order to assess its functional performance in advance.
The inspection methodology of gears should be accurate with less time consuming procedure for its inspection. This gear test rig will check the gear in minimum time which results in a decrease of non-productive time and improves plant efficiency.

Keywords: Parkinson's Gear Tester, Gear test rig, Gear Metrology, Mechanical Project.

I. INTRODUCTION

Today we are living in a generation in which world requires speed on each and every field. Hence most important part is rapidness and quick working. For achieving this rapidness, man manufactures various machines and equipments are manufactured in order to keep the growth rapid. The Engineer must bring new ideas and design into reality. New machines, equipment's and the methods are being developed continuously for production of various product at low cost and precise quality. In resembles of this quality, our project aims to design and development of Parkinson's gear tester for spur gear to check the Flank Surface. Being compact and portable equipment, it is skilful and precise in testing the gears being manufactured.

As most of the required material and equipment could be made easily available by our college and the parts could also be made in our college work-shop. Its price is also significant. This project gives us knowledge, experience, skill and new ideas for manufacturing. It is a working project and having a guarantee of success. This project equipment is useful to enhance the quality of the gear being manufactured and can be made in much lower time.

To check the combined tooth error different types of gear testing machines are used. Various machines have its ability to check specified parameters only. The highly precise machine required special installation and space. We required such an arrangement which is strong and rapid one for the purpose of checking gear in machine workshop. This purpose can be solved by using gear test setup. This type of gear test rig in helpful in manufacturing for mass production of gears of a specific gear box. Gear test rig in such arrangement which simplifies the measurement and saves worker time and overall production cost with higher accuracy. It works on the principle that master gear is attached to a fixed vertically oriented shaft and the gear to be tested on another identical shaft. The first gear acts as a master gear and the other gear is checked by using master gear as a reference gear. This result will help in resulting the composite error. The test rig setup can be used in work floor as it requires less space and worker can use it as per need without wasting much time.

II. LITERATURE REVIEW

R. K. Jain, "Engineering Metrology" Khanna Publishers, twentieth edition [2007], they have presented Parkinson gear tester as an efficient one for checking the flank surfaces of the gear and determine the error significantly. For efficient performance of the gear, this test rig is used they have performed three levels of test experiments considering flank surface. It was observed that this test rig can improve the life of gear.

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Shinde Tushar .B, Shital D. Tarawade, "Design & Development of Parkinson Gear Tester for Spur Gear to Check the Flank Surface". International Journal of Advanced Research in Mechanical Engineering & Technology (IJARMET). Vol. 1, Issue 1 [Apr. - Jun. 2015], they have found Parkinson gear tester to be extending gear life and reducing error. Their work aims to understand the accuracy of flank surfaces. This test rig is useful to find out the flank surface and irregularities in gear tooth with ease.

S. D Kalander Saheb and K. Gopinath, "A comprehensive survey of gear test rigs",
Report No 6, IIT Madras, Dec [1990], In this survey, they have performed the gear testing experiment and concluded that this test rig is the easiest to use equipment for checking any irregularity in gear tooth.

V. Manoj, "Development Of A Power Re-Circulating Gear Test Rig" M. Tech Thesis, IIT Madras, [1999], this paper states that Parkinson gear tester is most suitable equipment which can be used for determination of errors in flank surfaces.

III. PROBLEM DEFINATION

We design and developing a "Test rig on Parkinson gear tester" is being a compact and portable equipment, which is skilful and is having something precise in testing the gears. It checks the gear tooth profile of gears and checks the flank surface of gears. It can be used as a calibration device.

Objectives:
- Development of test rig.
- It must be easy to use.
- The test rig should give the accurate and precise results.
- It detects the effective error in tooth form.
- It must be robust and insensitive.

IV. PROPOSED METHODOLODGY

A. Concept Development:

The Parkinson's gear tester consist of following parts:
- Master gear.
- Test specimen-gear.
- Dial gauge.
- Motor.
- Spring.
- Floating carriage.

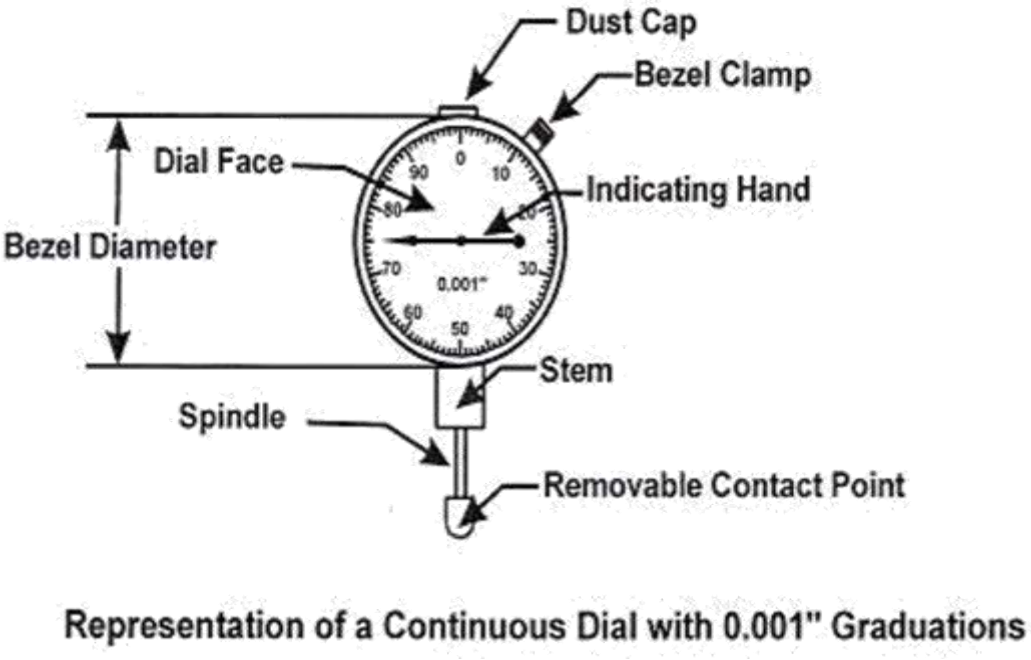

Fig. 1 Specifications of a Dial Indicator [6]

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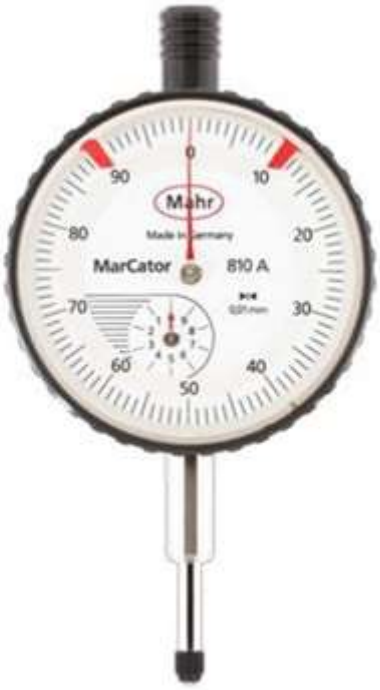

Fig. 2 Dial indicator [7]

B. Construction

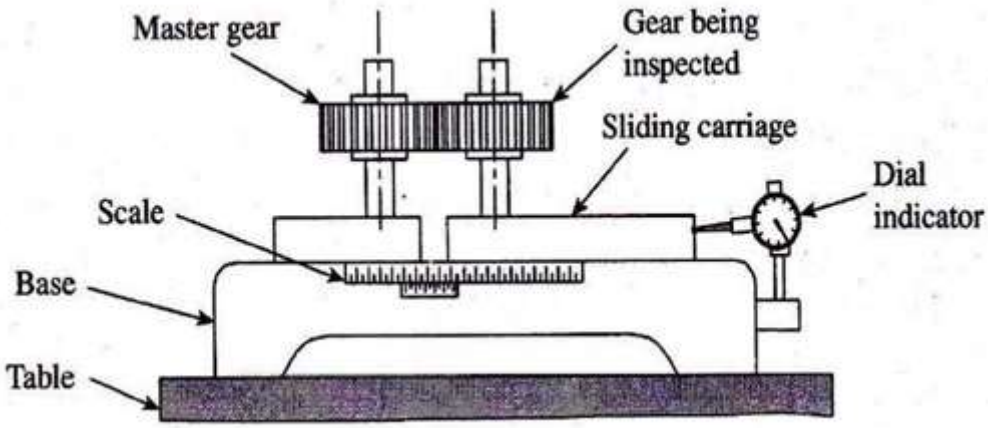

Fig. 3 Experimental set up of Parkinson Gear Tester [1]

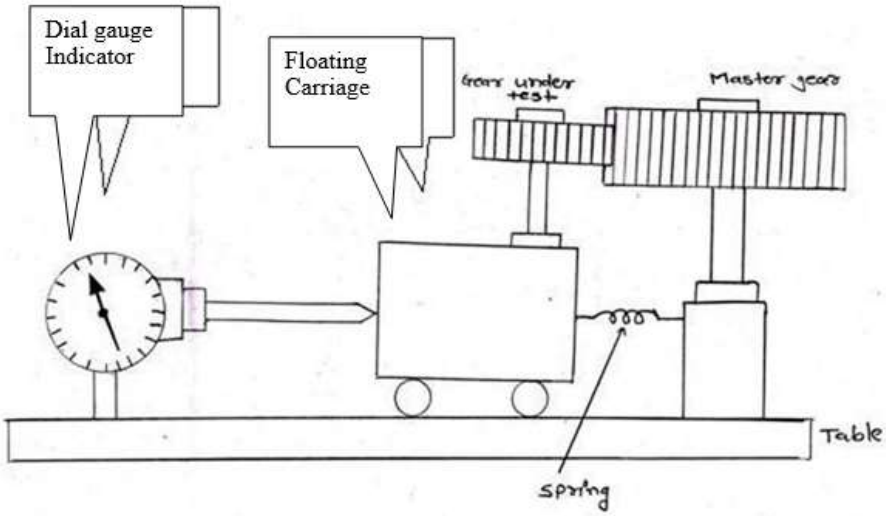

Fig. 4 Sketch of Concept Model

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These gears are attached on two shafts so that they are allowed to rotate without computable allowance. The right spindle can be moved along the table and clamped in any preferred position and the right spindle slide is free to move.

C. Working

To operate the testing machine, electric motor, which is torque motor having 5kg-m torque capacity, 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.

D. Selection of material

Following are some of the important factors on which selection of material is based:

1. Availability and cost of material
2. Strength and rigidity
3. Resistance to fatigue
4. Impact resistance
5. Hardness
6. Weight
7. Mach inability and weld ability
8. Corrosion resistance

However, the most of the significant reasons affecting the selection of material for engineering design is the properties of metals in relation to their intended use. The properties of metal define a specific characteristic of the material and behaviours of the metal under different conditions. We have selected low carbon or mild steel for fabrications of various component of our project due to following properties and composition of the material.

1) *Low carbon or mild steels*: Low carbon or mild steel has a carbon content from 0.15 to 0.30%. They are malleable, weld able and can be case hardened only. They are comparable to wrought iron in properties. Both ultimate tensile and compressive strength of these steel can be increased with increasing carbon content. They can be simply gas welded or electric arc welded, with the increase in the carbon content its weld ability increases. Mild steels are quite tough but easily machinable. It is cheaply available at reasonable price.

2) *Cast Iron:* It is manufactured by melting pig iron with wrought iron in the presence of manganese along with some percentage of phosphorous to have strength along with porosity. It is used to manufacture the components of Robert structure along with heat resistant and of intricate structure. The complex portions are separately cast and welded to the main structure or sometimes fastened using bolts or rivets. We have used following material for different components.

E. Master Gears

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. These can also be used for standardization of gear checking instruments used in work-floor. Master gears are made of chromium-manganese steel or high quality gauge steel and are hardened to 62 HRC. These are properly stabilized to release internal stresses. The master gears should preferably have lower module values because with coarse pitches the master gear would have either a very few teeth or else it will be relatively big, making it hard to handle besides high manufacturing cost.

Here we have selected the material as per the following:

TABLE I
COMPONENTS AND SPECIFICATIONS

Sr. no.	Name of component	Specification	Material
1	Main motor	220V 50Hz 1440rpm	STD
2	Dial indicator	55 MM Dia.	STD
3	Master gear	-	Medium carbon steel
4	Floating carriage	-	-
5	Frame	900x700x465mm	Mild Steel

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F. Gear Design

1) Design of Motor speed =1440 rpm
2) Rated power =$10x10^3$ w
3) Io/A = 10 approx.
4) Nominal power= Rated power ×service factor
   $=10x10^3 \times 1.5$
   $=15x10^3$ w
5) Type of gear= Spur gear
   1. Basic requirement:
      - Tooth profile: Involute
      - Pressure angle (α): 20
      - Type of tooth: Full depth
      - Type gearing: SN gearing
   2. No of teeth:
      1. $Z_1 = 2f_0 / \sin^2\alpha$
         $=2x1/\sin^2(20)$
         $=18$
      2. i = Z2/Z1
         Z2 = 73
6) Cal. of Lewis form factor(Y):
   $Y=\pi y$
   y = 0.154 - (0.912/Z)…….P.S.G. 8.50
   For z_1
   Y1=0.325
   For z_2
   Y2=0.445

7) Material selection

TABLE II
MATERIAL SELECTION

Type	Material	σ_y (N/mm^2)	σ_u (N/mm^2)	BHN
Master gear	C50	380	720	241
Test specimen	C35	310	570	187

8) Permissible bending stresses (σ_{b1}):
   Master gear ($\sigma b1$) $=1.4/n \times kbl / K\sigma \times \sigma\text{-}1$
   $=151.67$ N/mm^2
   Similarly,
   $(\sigma_{b2}) = 126$ N/mm^2

9) Permissible Crushing stress:
   (σc): $\sigma_{c1}=c_B \times H_{B1} \times kcl^{-1}$
   $=602.5$ N/mm^2
   Also,
   $\sigma_{c2}=469.7$ N/mm^2

10) Weaker element:
    $S_1 = (\sigma_{b1}) \times Y_1 = 49.29$
    $S_2 = (\sigma_{b2}) \times Y_2 = 56.07$
    $S_1 < S_2$,
    Thus, Master gear is a weaker element.
    Nominal power $=2\pi \times N_1 \times M_{t1}/60$
    $15x10^3 = 2\pi \times 576 \times M_{t1}/60$
    $M_{t1}=248.7$ N-m
    $M_{t1}=248.7 \times 10^3$ N-mm
11) Design Torque:
    $(M_{t1}) = M_{t1} \times k_d \times k$
    From (P.S.G. pg.8.15),
    $k_d \times k = 1.5$

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Therefore, $(M_{t1}) = 373.01x10^3$ N-mm. Ψ

Module (m) ≥ 1.26 √ $(M_{t1})/(Y_1 \times (\sigma_{b1}) \times \Psi_m \times Z_1)$

Therefore, m ≥ 4.381mm.

To take care of compressive stress due to radial load and the direct shear load which was neglected in the Lewis equation, Let us increase this value by around 20.

m ≥ 5.257 mm.

Selecting standard module from P.S.G data book = 6 mm.

G. Fabrication

In this, we assemble the parts to make a Parkinson gear tester. This gear test rig will be equipped with a Standard electric motor to drive the driving shaft for Master gear. Thus test rig will be developed to give the maximum accuracy in the flank surface of the gears.

H. Testing

After completion of the project till January-February, we will check that the listed objectives are achieved or not.

V. CONCLUSION

While concluding this part, we fill quite contended in having completed the project synopsis well on time. We had enormous practical experience on the manufacturing schedules of the working project model. We are, therefore, pleased to state that the inculcation of mechanical skill proved to be a very useful purpose. We are as such happily related to the arriving at the targeted mission. Certainly, the joint venture had all the advantages of interest and enthusiasm revealed by all of us the credit goes to the healthy co-ordination of our batch colleague in bringing out a resourceful fulfillment of our assignment described by the university. The design criterion imposed challenging problems which however were welcome by us due to the availability of good reference books. The proper selection of raw materials helped us in machining of the various components and obtaining very close tolerances and thereby reducing the level of wear and tear.

In this synopsis, we developed a branch and bound approach which is coupled with quick, gear testing in mass production requirement within a manufacturing cell. The design of control planning was a vital aspect of study because a strong interaction between the many different parts was desirable. We are testing gear with low running cost. Thus we are satisfied with our synopsis of the project.

REFERENCES

[1] R. K Jain, Engineering Metrology, Khanna Publishers, -2007

[2] V. B Bhandari, Design of machine elements, Mc-Graw Hill Education 2010.

[3] Shinde Tushar B., Shital D. Tarawade, "Design & Development of Parkinson Gear Tester for Spur Gear to Check the Flank Surface". *International Journal of Advanced Research in Mechanical Engineering & Technology (IJARMET).* Vol. 1, Issue 1 [Apr. - Jun. 2015].

[4] Paul, S. D. Kalander Saheb and K. Gopinath, "A comprehensive survey of gear test rigs*", Report No 6, IIT Madras,* Dec [1990].

[5] https://www.scribd.com/doc/91684281/Parkinson-Gear-Tester-Metrology.

[6] http://isoconsultantpune.com/measurement-systems-in-quality/

[7] https://en.wikipedia.org/wiki/Indicator_(distance_amplifying_instrument)

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