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3 Pin Constant Velocity Joint for Parallel Power Transmission

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ABSTRACT

A coupling is a widget used to interface 2 shafts along. The essential role of couplings is to join 2 parts of rotating component whereas allowing some extent of misalignment. By cautious choice, establishment, and support of couplings, generous reserve funds are often created in reduced maintenance price and time period. Presently Oldham's coupling and Universal joints are used for parallel offset power transmission. These joints have limitations on most offset distance/ speed and lead to vibrations and low potency. The 3 pin constant velocity joint is an alteration in design that provides up to twelve mm parallel offset, at high accelerates up to 2500 revolutions per minute 90% efficiency. This design reduces the price of production, area demand, and easy technology of manufacture as compared to present CVJ.

Keywords: 3-Pin Constant Velocity Joint, Parallel Offset, Angular Offset, Power Transmission, Von-Mises Stress

I. INTRODUCTION

The basic operation of a power transmission coupling is to transmit torsion from an input shaft to an output shaft at a given shaft speed and, wherever necessary, to accommodate shaft misalignment. Misalignment is that the results of several factors as well as installation errors and tolerance variations. Shaft misalignment will increase the axial and radial forces exerted on the coupling. In misaligned applications, undesirable facet loads are sometimes introduced by the coupling. These facet loads result from dynamic coupling behavior, frictional loads, and loads caused by flexing or compression coupling elements. The undesirable results include: 1) Torsional or angular velocity vibrations that scale back system accuracy. 2) Excessive forces and heat on system bearings that scale back machine life. 3) Enhanced system vibration and noise that adversely affects instrument operation.

In this paper, Section II reviews the structure of cleaning robot. List of components used in cleaning robot is given in Section III. Section IV gives the specification and details of components used and Section V discusses robot mechanism and Section VI shows basic design calculation and finally conclusion, acknowledgment & references.

II. PROBLEM DEFINITION

It is troublesome to calculate the articulated angle throughout operation due to the restricted area obtainable also because of the high speed of the rotating shaft. Complicating the matter more is that the movement of the wheel suspension that affects the rotating shaft. The matters are to calculate the vertical part, of the articulated rotating shaft angle, correctly. When considering totally different solutions for the matter sure aspects have to be compelled to be consummated. The solution to the mentioned problem is an indigenous coupling that provides constant transmission of torsion and angular velocity. The important options of the coupling being;

- Minimize or perhaps eliminate facet loads

- Higher shaft misalignment capabilities

- Higher drive accuracy.

The Thompson Constant velocity joint is an ideal solution to the power transmission between shafts at an angle of 30degree to 65 degrees, the only wearing parts being the trunion joints. The Thompson constant velocity joint ensures that no fluctuating loads are transmitted across to the output shaft.

III. PROPOSED SYSTEM/WORK

A coupling could be a device used to connect 2 shafts along at their ends for the aim of transmission of power. Couplings don't commonly enable disconnection of shafts throughout the operation, however, there are torsion limiting couplings which might slip or disconnect when some torsion limit is exceeded.

The primary purpose of couplings is to affix 2 items of rotating instrumentation whereas allowing some extent of misalignment or finish movement or each. By careful choice, installation and maintenance of couplings, substantial savings are often created in reducing maintenance prices and time period.

Following activities are going to be meted out throughout this proposed work. It includes literature survey, system design, mechanical design, fabrication, assembly, testing and experimental analysis, and comparative study etc.

1. Literature Review: Study numerous power transmission drives in mechanical systems exploiting various drive-train handbooks, Technical papers.
2. Development of Theory: 1) System Design: This half includes the planning and development for the kinematic linkage as per the pure mathematics to provide the required output. 2) Mechanical Design: This half includes the planning and development of linkages, choice of appropriate drive motor, strength analysis of many elements of the given system of forces
3. Fabrication: appropriate manufacturing strategies are going to be utilized to fabricate the elements then assemble the test set –up. The fabrication is going to be meted out as per layout is shown below.
4. Testing: Testing of a pump to derive performance characteristics namely:
   Torsion vs. Speed
   Power vs. Speed
   Efficiency vs. Speed

IV. SYSTEM DESIGN

In system design we tend to primarily concentrate on the subsequent parameters:

1. System selection based on Physical Constraints

While choosing any machine it should be checked whether or not it's aiming to be utilized in a large-scale business or a small-scale business. In our case, it's to be utilized by a small-scale business. Therefore space may be a major constraint. The system is to be very compact in order that it is adjusted to the corner of a space.
The mechanical design has direct norms with the system design. Therefore the foremost job is to manage the physical parameters in order that the distinctions obtained when a mechanical design is well fitted into that.

2. Arrangement of assorted elements

Keeping into view the area restrictions the elements ought to be arranged such that their simple removal or service is feasible. Moreover, each element ought to be simply seen none ought to be hidden. each attainable area is used in element arrangements.

3. Components of System

As already expressed the system ought to be compact enough in order that it is accommodated at a corner of a space. All the moving elements ought to be closed & compact. A compact system design offers a high weighted structure that is desired.

4. Man Machine Interaction

The friendliness of a machine with the operator that's in operation is a very important criterion of design. it's the appliance of anatomical & psychological principles to resolve issues arising from Man – Machine relationship. Following are a number of the topics enclosed during this section.

- Design of foot lever.
- Energy expenditure in foot & hand operation.
- Lighting condition of a machine.
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5. Chances of Failure

The loss incurred by the owner just in case of any failure is a crucial criteria for design. Factor safety whereas doing mechanical design is kept high in order that there are fewer possibilities of failure. Moreover, periodic maintenance is needed to stay unit healthy.

6. Servicing Facility

The layout of elements ought to be specified simple service is feasible. Particularly those elements that need frequents service is simply disassembled.

7. Scope of Future Improvement

The arrangement ought to be provided to expand the scope of labor in future. Like to convert the machine motor operated; the system is simply organized to require one. The die & punch is modified if needed for alternative shapes of notches etc.

8. Height of Machine from Ground

For ease and luxury of the operator, the peak of machine ought to be properly decided in order that he might not get tired throughout the operation. The machine ought to be slightly on top of the waist level, additionally, enough clearance ought to be provided from the bottom for the cleanup purpose.

9. Weight of Machine

The total weight depends upon the selection of material components also because of the dimension of components. A higher weighted machine is troublesome in transportation & in an exceedingly case of major breakdown; it's troublesome to take it to the workshop owing to a lot of weight.

V. OBSERVATION

Table 1: 3 pin joint loading readings and unloading readings

LOADING		UNLOADING		MEAN
WEIGHT (KG)	SPEED rpm	WEIGHT (KG)	SPEED rpm	SPEED
0.2	1480	2	1460	1470
0.4	1400	4	1410	1405
0.6	1320	6	1340	1330
0.8	1210	8	1190	1200
1.0	960	10	920	940

Simple Calculations (at .8 kg load):

1. Average Speed :

$$N = \frac{N_1 + N_2}{2} = \frac{1210+1990}{2} = 1200 \text{ rpm}$$

2. Output Torque:

T_{dp} = Weight in pan x Radius of Dynobrake Pulley

= (0.8x 9.81) x 25

= 196.2 N.mm

T_{dp} = 0.1962 N.m

3. Input Power: $(P_{i/p})$ = 29.6 WATT

4. Output Power: $(P_{o/p})$

$$P_{o/p} = \frac{2\,\Pi N T_{o/p}}{60}$$

$$= \frac{2 \times \Pi \times 0.1962 \times 1200}{60}$$

$P_{o/p}$ = 24.6 watt

5. Efficiency:

$$\eta = \frac{Output\ Power}{Input\ Power}$$

$$= \frac{24.6}{29.6}$$

η = 83.1%

⇒ Efficiency of transmission of gear drive at 0.8 kg load = 83.1%.

Table 2: Result

LOAD (kg)	SPEED (rpm)	TORQUE (N.M)	POWER (watt)	Efficiency
0.2	1470	0.04905	7.55164	25.5123
0.4	1405	0.0981	14.43545	48.7684
0.6	1330	0.14715	20.49731	69.24766
0.8	1200	0.1962	24.65842	83.30546
1.0	940	0.24525	24.1447	81.56993

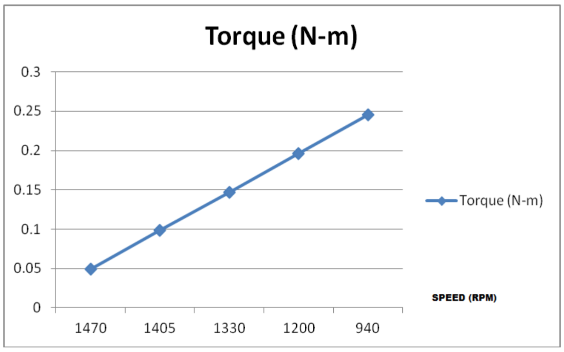

Figure 1: Speed vs. Torque

Figure shows that torque increases when output speed of coupling decreases.

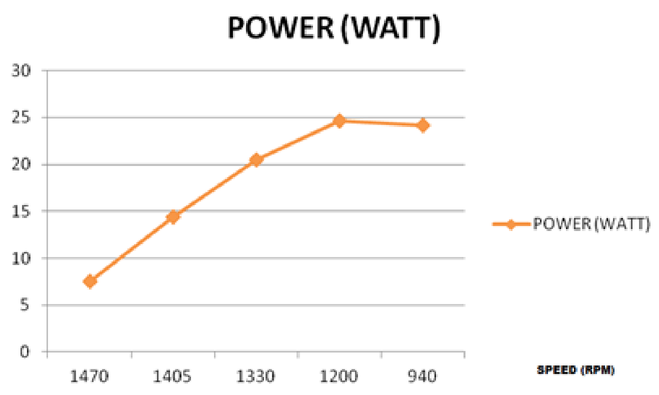

Figure 2: Speed vs. Power

Figure shows that at 1200 rpm coupling delivers maximum power. Thus this speed is recommended at maximum parallel offset condition.

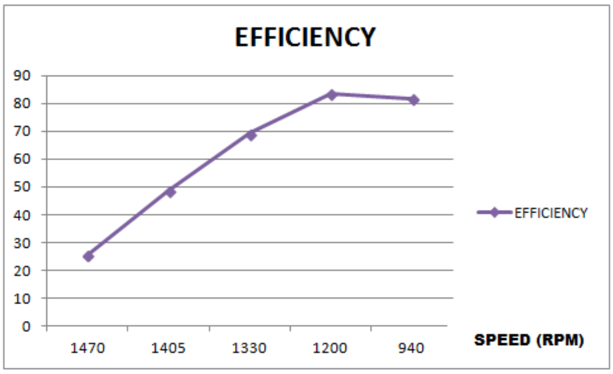

Figure 3: Speed vs. Efficiency

Figure shows that maximum efficiency is gained by the coupling at 1200 rpm.

VI. CONCLUSION

Maximum stress by the theoretical methodology and Von-mises stress are well below the allowable limit; therefore the output trunion holder is safe. Trunion holder shows negligible deformation. The 3 Pin Constant velocity joint is a perfect resolution to the power transmission between shafts at an angle of 20 degrees to 25 degrees, the only carrying components being the trunion joints. The 3 Pin Constant velocity joint ensures that no unsteady loads are transmitted across to the output shaft.

VII. ACKKNOWLDGMENT

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REFERENCES

[1] Mr.S.B.Jaiswal and Prof. M.D. Pasarkar, "*Failure Analysis of Flange Coupling In Industry*", Joural of Emerging Techno. and Advanced Engineering, volume2, 5may2012.

[2] Mr.Fredrik Doberaure and Daniel Hogberg, "*Torque and joint angle collective for driveshaft*", Cooney Jr C et al. (1979) Universal Joint and Driveshaft Design Manual Pierburg B, Amborn P. (1998) Constant-Velocity Driveshafts for Passenger Cars.

[3] "The Thompson coupling velocity joint by", Australian company Thompson coupling Ltd.2000 In nov.2009.

[4] Tae-Wan Ku , Lee-Ho Kim, Beom-Soo Kang, "*Multi-stage cold forging and experimental investigation for the outer race of constant velocity joints*," Materials and Design 49 (2013) 368–385.

[5] Chul-Hee Lee 1, AndreasA.Polycarpou, "*A phenomenological friction model of tripod constant velocity (CV) joints*," Tribology International 43 (2010) 844–858.