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DESIGN AND DEVELOPMENT OF CONSTANT SPEED VARIABLE DISCHARGE PUMP FOR VARIOUS APPLICATIONS

Mahesh R. Pawar
Asst. Prof. Department of Mechanical Engg.
Dr. D. Y. Patil Collage of Engg. & Innovation, Varale, Talegaon, Pune, India-410507
mahesh.pawar@dypatilef.com

Rohit C. Shewale
BE, Department of Mechanical Engg.
Dr. D. Y. Patil Collage of Engg. & Innovation, Varale, Talegaon, Pune, India-410507

Sunil B. Shinde
BE, Department of Mechanical Engg.
Dr. D. Y. Patil Collage of Engg. & Innovation, Varale, Talegaon, Pune, India-410507

Avinash R. Pedgaonkar
BE, Department of Mechanical Engg.
Dr. D. Y. Patil Collage of Engg. & Innovation, Varale, Talegaon, Pune, India-410507

Sanjay A. Pawar
BE, Department of Mechanical Engg.
Dr. D. Y. Patil Collage of Engg. & Innovation, Varale, Talegaon, Pune, India-410507

ABSTRACT—The project works deals with design & development of constant speed variable discharge pump for lathe machine. In this project the constant discharge pump is replaced by variable pump using constant speed motor. The aim of project is to obtain the variable discharge of pump which is used for achieving various speed in various operations. The variation of discharge is achieved by arrangement of cam and follower and by using linkage to vary the discharge. For achieving variable discharge the important parameters which are to be studied are distance of linkage, cam and follower, angle of linkage. For designing cam and linkage the CATIA software is used. The testing is done by calculating time for various discharge.

Keywords- linkage, variable discharges, constant speed.

I.INTRODUCTION

A pump is a device that is used to transfer fluid form one position to another position by mechanical action. There are three types of pump according to method used for transferring fluid direct lift pump, displacement pump and gravity pump. In case of axial piston pump with constant pressure and variable flow, it has that ability to control the flow by controlling the pressure. The bent axis piston pump cannot be used because of its high cost and leakage problem. Therefore the modification is needed in radial piston pump. The mechanical linkages are used and mechanism is created to obtain step less variation in discharge. Singular control which will help to control the flow of discharge with just movement of lever. Wide range can be obtained by single control. Variable discharge pump will overcome the constant discharge pump by just using four bar mechanism. In this four bar mechanism, Which consists of fixed link, input link, output link and connecting link.by changing length of connecting link, variable discharge is achieved. The motion of connecting link is locomotive. In this project we have used axial piston pump which is cam operated. The cam is mounted on output shaft which is operated by output yoke. Change in length of link create variation in output yoke speed and this cause variation in change of discharge of pump

II.EASE OF USE

Step less variation of discharge is obtained. Singular control which will help to control the flow of fluid with single control.

Variable discharge pump will overcome the constant discharge of pump by just using four bar mechanism. In this constant speed variable discharge pump, wide range of discharge ratios can be obtained. The changing of discharge is gradual which can be achieved by rotating the control link. The controlling operation is easy and can be operated single handedly.

III.REVIEW

An analytical approach to mechanisms to achieve accuracy and motion with transmission ratio and constraints. The mainly used mechanisms are 4-bar and slider crank mechanism. There are some gear drives and belt which also transmit power but there are some losses. To overcome this 4-bar linkage is used. Its transmission ratio is one or constant when it is parallelogram. But it is theoretical. Variation of link length results in variation in transmission ratio was concluded by Conor Walsh and et al [1].

The synthesis, analysis and experimental validation of variable displacement six-bar crank-rocker slider mechanism that produces low friction than conventional pump. Synthesis technique will develops the range of motion for four bar crank- rocker mechanism. With the help of their synthesis technique we have developed linkage and given by Shawn R. Wilhem and et al [2].
Piston pump test to evaluate the performance of all classes of hydraulic fluid. Mineral oil is used first which is available easily and at low cost, it have good lubrication property but at higher pressure of piston pump may lead to fire hazard. While using non-mineral oil, properties are checked which shows no fire hazard and good lubrication property was given by Dr.George E.Totlen and et al [3].

To find volumetric efficiency of axial piston pump by evaluating compressibility losses of fluid. But they found that there is fluid leakage losses and less operating efficiency. To overcome this we used axial piston pump with mechanical linkages and was given by Noah D.Manring and et al [4].
The variable displacement link which will give required discharge at particular position. In hydraulic power system, variable discharge pump is used for power saving, increase in productivity or controlling load.by studying this we used this link for power transmission and it was given by Mr. H.T.Kekare and et al [5].

Various dynamic equations which describes the behavior of hydrostatic transmission by combining a variable displacement axial piston pump and fixed displacement motor. The study shows that varying of different parameters causes different effects on system rise time, settle time, maximum percentage overshoot and this work is given by N.D.Manring and et al [6].

The bent axis piston pump is capable for operating at variable condition of flow such as pressure, speed and torque. But fluid leakage and less operating efficiency. To overcome this we used axial piston pump with mechanical linkages and it was studied by V. R. Ghodke and et al [7].
By manual control discharge of pump is varied from zero to maximum as angle between the 2 crank decreased, strokes of the piston increased so discharge is also increased. As angle between 2 crank is increased, stroke of piston pump decreased so discharge is also decreased.so study is carried out to vary the discharge and this was given Nisha R. Patil and et al [8].

They converted flat face follower to a curved face follower, so that point of can be achieved. The overall study gives the reduced friction between contact and increases the mechanical efficiency. It is also seen that the existing vibration is reduced in the mechanism and it was studied by Mahesh R. Mali and et al [9].

IV. NOMENCLATURE

Table. 1: Nomenclature

Sr. No.	Symbol	Description
1	T	Torque(N)
2	N	Speed(rpm)
3	f_{sy}	Permissible shear stress(N/mm^2)
4	f_{yt}	Permissible yield stress(N/mm^2)
5	f_{os}	Factor of safety
6	M	Moment (N-mm)
7	I	Moment of inertia (mm^4)
8	Y	Distance from neutral axis(mm)
9	J	Polar moment of inertia (mm^4)
10	D	Diameter (mm)
11	F_{max}	Maximum shear stress (N/mm^2)
12	f_a	Axial load (N)
13	f_r	Radial Load (N)
14	X	Axial Load Factor
15	L	Life of Bearing
16	Y	Radial Load Factor
17	C	Capacity of Bearing

V. METHODOLOGY

There are many machines and mechanical units that under varying conditions make it desirable to be able to drive at an less perceptible speed , an inter mediate speed or a high speed. Thus an infinitely variable speed can be obtained. Step-less speed variation in which it is possible to get any required speed.

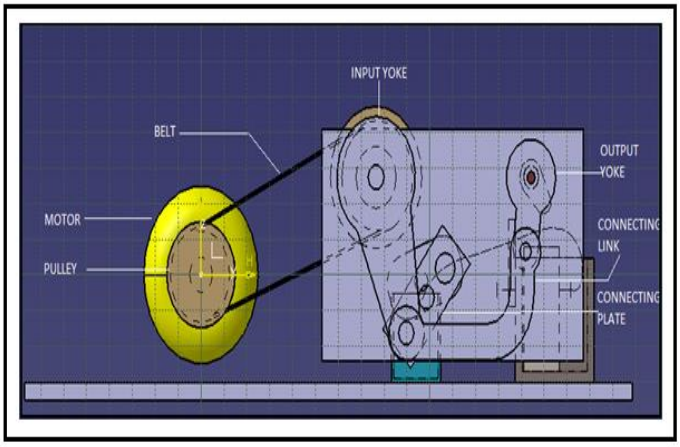

Fig.1:-Layout

At increased driving torque the torque Vs speed characteristics do not match the step less drive at low speeds. Hence there is necessity of a step-less drive with the following characteristics

- Infinitely variable speeds.
- Variation of speed can be represented widely.
- Shock less shifting from one speed to another one.
- Minimum number of controls for speed changing.
- Ease of operation.
- Compact construction.

Presently the machines employ the continuously varying drive i.e. split cone pulley drive in conjunction to two

speed gear box. The belt drive does not give a fixed velocity ratio, leading to variations in dimensions of spring, more over maintenance is a issue along with frequent belt replacements.

There is thus a need of a mechanical drive to give ratios 1:4 to 0 to cover range of product.

VI.CALCULATIONS

1. **Motor**
   Specifications:-
   Power:- 50W
   Range:- 0-9000 rpm
   Operating speed:- 4000 rpm
   T =0.12Nm
2. **Bearing(SKF)**
   Bearing no.:-6003
   Static capacity:-2850 N
   Dynamic Capacity:-4650 N
3. **Bearing(SKF)**

Bearing no.:-6201
Static capacity:-3000 N
Dynamic Capacity:-5400 N

VII.END RESULT

Table 2: Results

Product Name	Material	Yield Strength (Mpa)	Diameter (mm)	Area (mm^2)
Input Shaft	EN24	600	16	-
Output Shaft	EN24	600	16	-
Connecting Pin 1&2	EN24	600	8	-
Connecting Plate	C40	380	-	146
Output Yoke	C40	380	-	100
Connecting Link	C40	380	-	72

VIII.CONCLUSION

In conventional pumps variable discharge cannot be achieved, but by using variable links and mechanism variable discharge can be achieved. There are some pumps which give variable discharge but they have some limitations like low efficiency & leakage to overcome this radial pump is used.

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