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# Variable Displacement Pump Using Constant Speed Motor

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## ABSTRACT

This paper present variable displacement linkage which use for desired position displacement. Using this particular displacement run a radial piston pump for variable discharge. In hydraulic power systems, variable displacement pumps save power, increase the productivity or control the motion of a load precisely, safely and in an economical manner .The displacement varying mechanism and power to weight ratio of variable displacement piston pump makes them most suitable for control of high power levels. Positive Displacement Pumps are "constant flow machines" Thus objective of research is defined to develop a variable displacement linkage that will enable to vary the stroke of an two cylinder radial piston pump, thereby offering to vary the discharge of the pump using manual control.

**Keyword**: Piston Pump, Positive Displacement Pump

## I. INTRODUCTION

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. A Positive Displacement Pump must not be operated against a closed valve on the discharge side of the pump because it has no shut-off head like Centrifugal Pumps .A Positive Displacement Pump operating against a closed discharge valve, will continue to produce flow until the pressure in the discharge line are increased until the line bursts or the pump is severely damaged - or both. Axial piston pumps with constant pressure and variable flow have extraordinary possibilities for controlling the flow by change of pressure. Owing to pressure feedback, volumetric control of the pump provides a wide application of these pumps in complex hydraulic systems, particularly in aeronautics and space engineering.

The major obstacle in application of the bent axis piston pump is extremely high cost over that of the radial piston pump , it ranges in the range of 5 to 6 times the cost of radial piston pump. Hence there is a need to develop a modification in the radial piston pump design that will offer a variable discharge configuration in addition to the advantages of high efficiency and maximum pressure. Thus objective of project is defined to develop a variable displacement linkage that will enable to vary the stroke of an two cylinder radial piston pump , thereby offering to vary the discharge of the pump using manual control.

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## II. METHODS AND MATERIAL

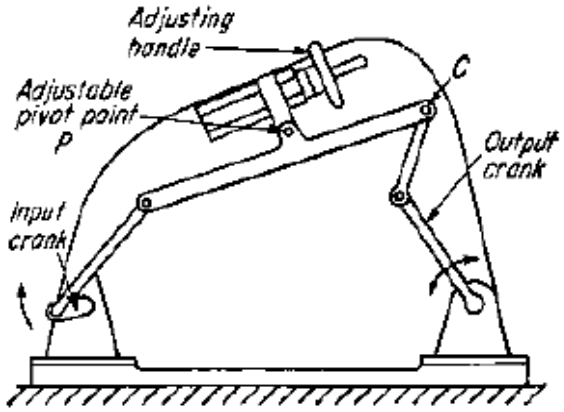
1) 1) System design as to kinematic design of one linkage set to 30 degree output
2) System Design and geometrical derivations of the linkage to integrate individual linkage output to get the desired 1:4 ratio
3) System Design and geometrical derivations of the control linkage to achieve single lever control and derive the desired output in step-less manner
4) Selection and geometrical profile of shifter mechanism.
5) Selection and design of cam profile , linkage geometry for minimum space occupation and minimum inertia to make drive compact, light weight and precise.
6) Selection of motor drive transmission.
7) Mechanical design : This part includes the design and development of linkages , section dimensions for strength criterion. The linkage section dimension will be calculated using theoretical derivation using appropriate theories of failure and the dimensions.

- The following components of the drive will be designed.
- Input eccentric
- Connecting link
- Output link
- Control link

### 1. Problem Statement:

The system design consists of development of the mechanism so that the our concept can perform the required operation. The mechanism is basically an inversion of four bar kinematic linkage, hence the mechanism is suitably designed using Grashoff's law and the final outcome is shown in Auto cad software below fig. Here four links with one control link arranged for variable output without changing input. The speed changing mechanism is simple in construction. It consists of a control shaft that is mounted on two cranks that are hinged to the frame. The control shaft carries a handle. Turning the handle changes the position of the connecting link connecting rod joint which will lead to change in the degree of oscillation of the output yoke thereby speed change of the output shaft.

### 2. Experimental setup




Figuer 1

The designed linkages converted into experimental set up . Input shaft coupled to the motor by coupling at one end. Connecting rod is an element which is imparted oscillating motion by the input shaft. Connecting link is the member that connects the connecting rod to the output yoke. The control link is the speed governing member, it changes the position of the joint of the connecting link with connecting rod. Output yoke is connected to the connecting link which oscillates it about the output shaft as shown in Figs.

### 3. Working

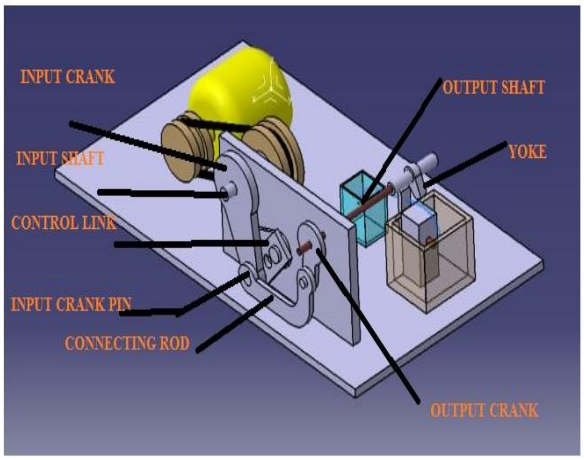



Figure 2

**Working:**

When motor start rotating it is pulley rotate and transfer the rotational motion to the input of linking mechanism via belt drive. There is eccentricity between input shaft and input crank there for it oscillate instead of rotation.

The moment or angle or intensity of oscillation is controlled by the control link which further decide the flow rate and it our main aim through this project. The connecting rod is connected with control link which transfer motion from input crank to output crank .output crank is oscillating because of motion transform into and from motion; this motion is transfer to yoke via output shaft.

The yoke movement is power source to the pump, so when yoke oscillate pump operate and flow start.

Our aim is to get variable flow so by adjusting control link we can increase or decrees the yoke speed and flow get varied.

## III. SCOPE OF THE PROJECT

As the world progressing at faster rate we meet mover and The following features of the drive will lead to application of drive in variety of field applications:

**Step-less variation of speed** : Any speed between Nmax to N min can be obtained . The conventional gives fixed speed ratios, that too in steps. This will help replace the costly electrical variable speed drives conventionally used for spindle and slide drives in machine tool applications, packaging machinery etc.

**Specific applications:**

The device can be applied to automatic transfer lines where in the speed of conveyor varies as per the job sequence and operations to be performed, so every time it is necessary to change the gear box to vary the rotational speed of conveyor hence the developed device will serve the purpose and eliminate need of separate gear box for each setting of conveyor speed.

**Wide range of speeds Ratio:** The speed ratio can be varied one a wide range which is not possible in conventional gear box. This will be especially useful in spring making machinery, textile machinery, printing machinery and automatic transfer lines.

**Specific applications**

The device developed offers close to 200 speed ratios, hence this device can be easily used in spring making machine where in it will be possible to vary the pitch of the springs thus produced with precision and a range of close to 200 different pitches will be offered by application of the device.

**Compact size:** The size of the gear less variable speed reducer is very compact; which makes it low weight and occupies less space in any drive.
Used.

## IV. CONCLUSION

The development of our project can be used to the various applications in effective manner .The developed prototype exhibits the expected results. Further modifications and working limitations will put this work in the main league of use. From this concept it is possible to vary discharge of reciprocating pump by using linkage arrangement instead of other expensive arrangement .By development of this model there is no need of

replacing fixed displacement reciprocating pump for sake discharge variation . As this concept is the extension of step less drive so that this concept posses advantage of step less drive.

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