A Review Paper on Reciprocating Pump

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Abstract— The working of the reciprocating pump is very simple and just like an I.C engine. First of all the piston has the function of providing the suction force, so that the liquid can be lift up and can be sucked in with great force. After that comes the compression part which will bring the required pressure energy to the fluids. In this part of the phase the piston have to do a great work so that the liquid can be compressed properly and its pressure can be increased to the desired level. The inlet and the outlet valve open at a certain pressure which is set by the manufacturer. If the piston is of single acting type which means it can suck from one side and transmit to the same side only. But we can have the double reciprocating pump too which have the function of the giving suction and discharge simultaneously in each stroke. This pump can be used as the compressor also but for that we have to have a good valve arrangement which can operate with good efficiency. Note: It is to be noted that the reciprocating pump is a positive displacements pump which means that the fluid can only move in one direction and can never reverse back. So due to this the pump is always started with outlet valve open otherwise the pressure will keep on building and this will lead to rupturing of the pipeline or even the pump itself. But if relief valve is fitted then this pressure will come down.

Key words: Reciprocating Pump, Pump Transmits Fluid

I. INTRODUCTION

Pump transmits fluid from one place to the other place. There are pumps any kind of pumps available in the market like centrifugal pumps, gear pump, reciprocating pump etc. The selection of pump depends on different kind of requirements like operating pressure, overall efficiency, discharge, cost effectiveness etc. Reciprocating pump is one of the most important types of pump used in many industrial applications and also in some of the domestic applications. In reciprocating pumps, the fluid enters the pump body through the inlet port provided and gets compressed by the application of the piston force to particular desired pressure. The outlet port delivers the compressed fluid to the required height or place. Designing the pump and also visualisation of inside fluid of the pump is very difficult as well as time consuming and costly. Computational Fluid Dynamic (CFD) analysis is a best tool available now a days for analysing the flow patterns inside the reciprocating pump and predicting the behaviour of the pump under different operating conditions. CFD also helps to optimise the design parameters of the pump by giving nearly correct flow patterns along with more effective working of the pump

II. LITERATURE REVIEW

[1] Studied collision characteristics for reciprocating pump using FEA and experimental. In this study, the valve disc motion parameters have been measured directly by displacement and acceleration sensor, where both are mounted on the valve disc. The test data has been used as valve motion parameters to simulate the collision process by ANSYS/LS-DYNA software. Valve disc vibration displacement and velocity signal has been studied for different strokes. The simulation and experimental results have been used for studying pump valve failure mechanism, optimization of design and then improving pump services life. Approximation theory has 2.12% less displacement of valve disc as compare to U.Adolph theory for stroke of 200 (times/min). Kumar et al.

[2] Studied flow analysis inside jet pump used for oil wells. In this study, Reynolds-averaged Navier Stokes (RANS) equation has been solved. The turbulence k-ε model has been used for simulation. The numerical study has been performed for different primary and secondary fluids. The effect of the area ratio and the throat length on the performance of the jet pump has been studied. The result indicated that the efficiency of the jet pump increased up to 20% to 30%. Hubacher and Groll

[3] Studied crankshaft bearing analysis of a single stage, Semi-Hermetic Carbon Dioxide compressor. In this study, the friction loss analysis has been conducted, which was used previously obtained compressed performance data as inputs. In the first step, the force loads acting on the two crankshaft bearing have been predicted based on the operating conditions. In the next step, the predicted force loads have been used in the bearing loss analysis. The result indicated that the frictional losses of the two crankshaft bearings contribute with approximately 19 to 43% to the total frictional losses. Deng et al

III. WORKING PRINCIPLE

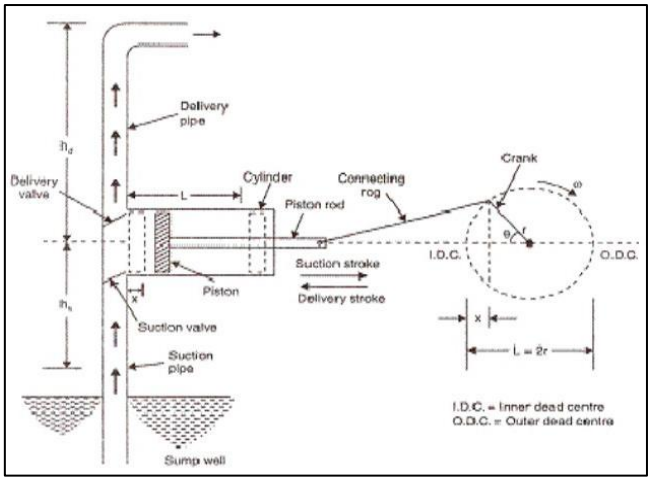

Fig. 1: Working

The Working Principle of Reciprocating Pump Is states as: During the motion of the piston from left to right (see the fig given above.) a partial vacuum is created inside the cylinder. Because of this low pressure water will rise from well through suction tube and fill the cylinder by forcing to open the suction valve. This operation is known as suction stroke.

(Motion of piston from left to right). In this stroke crank rotates θ=0˚ to θ=180˚. Also delivery valve will be closed and suction valve will be open during this stroke. When the crank rotates from θ=180˚ to θ=360˚ piston moves inwardly from position right to left. Now piston exerts pressure on the liquid and due to which suction valve closes and delivery valve opens. The liquid is then forced up through delivery pipe. This stroke is known as delivery stroke. Now the pump has completed one cycle. The same cycle repeated as the crank rotates.

IV. CONCLUSION

Reciprocating pumps are widely used in the different kind of industries. Proper selection of the equipment with the correct configuration of options is essential to providing and operating reliable M/C. The pump and the system iteraction is also a vital part of reliable operation. The pump cannot be viewed in isolation, how it interacts with the system can also cause operating life and premature failure.

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