A Review on Design and Analysis of Automatic oil filling pump

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Abstract – Automatic oil filling pump is an arrangement of interconnected components that control hydraulic energy. In the manufacturing of tiles industrious the die and punch has become the main component for the consideration of the design and accuracy, small error in the die can cause huge damage in the accuracy as well as in design. In that scenario we observe that the ceramic people use rubber cover on the die for smooth operation and ease in design but the oil pressure between die and rubber cover should be uniform. But in practical case the oil pressure is not uniform in the procedure. Another one problem is that the oil filling operation by manual hand pump is very laborious, moreover it's very time consuming, and it required very high pressure and though the rubber cover is sometimes damage and the cost of the rubber is very high for changing is at a time. So, the aim of this project is to design hydraulic system and analyzing different pumps for the application.

Key Words: Die and punch, design and accuracy, oil pressure, manual hand pump, laborious, high pressure, rubber cover.

1. INTRODUCTION

Most of cases, industries have to face a many types of problem and it may be create big loss in company so that we can identified problem. A hydraulic system is any component that uses a fluid to generate and transmit energy from one point to another within the enclosed system. This force can be in the form of linear motion, force or rotary motion. Some industries can give a big chance to work on that problem and find optimum solution for that company and also system will work very quickly. In past, oil is filled by hand operated and it may be very time consuming process so that it can be replaced by automatic oil filling pump. It consists basically of an integral electrical motor, with associated tank. The pump or motor unit may be mounted on the tank or separately and packs are usually available in either horizontal/vertical configuration. Relief and check valves are normally incorporated on the tank. The basic unit may be piped to the cylinders or actuators through a suitable control valve. Hose assemblies are generally preferred to rigid piping for connecting the power pack to actuators. The hydraulic power packs consist of a reservoir tank that house the hydraulic fluid, which is the basic working medium. The reservoir is also equipped with an air breather at the top to maintain the pressure in the tank at the atmospheric pressure and filters the oil to 40 microns.

2. WORKING PRINCIPAL

The working of a power pack commences when the pump is initialized with the help of an electric motor coupled to it. The oil is pumped from the reservoir along the suction line through a suction strainer with a capability to retain the foreign particles up to 149 microns.

Fig. 1.1 working model

From the suction line the oil is forced in to the pressure line through the pump at 35 bars. There is provision to measure the pressure, with the help of a pressure gauge. An isolator is used to measure the pressure immediately in any line. When the set of pressure is reached, the fluid moves to the cylinder present at the fixture (clamp). The hydraulic energy of the fluid is converted back to the energizing of the solenoid valve, the linear movement of the clamps (clamping and unclamping) is controlled. When the solenoid valve is energized in reverse, unclamping of the work piece occurs. There is a return line provided so that the used fluid may be utilized again. Due to the friction losses, total energy is not converted into the useful work so a part is converted into the heat. So, a heat exchanger is incorporated. The return line filter has a return capacity of 10 microns.

3. LITERATURE REVIEW

Three literature review which identify my research on Automatic oil filling pump;

[1] This project is set out to develop a high precision ceramic fabrication approach suitable for mass production, and to meet the needs of micro engine application. A group of new processes have been developed and the results are characterized for fabrication of high precision ceramic oxides and composite micro components using soft lithography and colloidal powder processing. The materials chosen in the research are alumina, yttrium stabilized zirconium and their composite for their excellent properties at high temperature. The research can be divided into four main sections. In the first section fabrication processes high precision hard and soft molds were studied. The process for producing SU-8 hard molds and PDMS soft molds were optimized. In particular, much attention was paid to obtain vertical and straight sidewalls, dimensional accuracy, and smooth surfaces of the molds. BPR100, DRIE silicon, reinforced PDMS and Dragon Skin was experimented as alternatives to fabricate hard and soft molds. In the second section, water, solvent and paraffin wax slurry systems were tested to fill PDMS soft molds. A comparison study was carried out to choose the best slurry system based on their outputs. Damage free micro components with different sintered properties were successfully produced using the proposed slurry systems. It was found that micro components fabricated using the water-based slurry show distinctive advantages over solvent and paraffin wax-based slurries in its high density and low shrinkage properties.

[2] Hydraulic power pack is described for supplying hydraulic fluid under pressure for operating apparatus such as hydraulic work over units used in servicing oil and gas wells. The power pack provides substantially constant hydraulic power input to the driven apparatus over a wide range of pressures and flow rates. The power pack includes a constant speed engine, a gear box driven by the engine, a bank of positive fixed displacement pumps of varying sizes driven by the gear box and having discharge ports connected with a common discharge manifold, a hydraulic fluid reservoir, an intake manifold between the reservoir and the pumps, and a return line to the reservoir. A recirculating line connects between the discharge from each of the pumps and the return line, and an unloading valve in each of the recirculating lines is operable responsive to the pressure in the discharge manifold for recirculating each of the pumps to the reservoir at a predetermined pressure value. Each of the unloading valves is set to open at a different pressure ranging from a minimum at which all of the pumps discharge to the discharge manifold to a maximum above which all of the pumps recirculate to the reservoir.

[3] A hydraulic pump with a built-in electric motor wherein an electric motor and a pump unit are arranged in tandem fashion and accommodated within a common housing. In this pump, the housing is in the form of a metal box having a rectangular parallelepiped external shape and forms an electric motor frame fixedly accommodating a stator of the electric motor therein. A space in the metal box on the electric motor side is separated as a dry space from an internal space of said pump unit by a seal mechanism. At least one hydraulic oil receiving chamber is formed in a peripheral wall of the metal box, and the hydraulic oil receiving chamber is communicated with a passage for receiving return oil externally and another passage communicating with a suction port of the pump unit. The pump is capable of simultaneously achieving the cooling of a built-in electric motor and the prevention of contamination of hydraulic oil due to the rotation of the electric motor, without any possibility of electrical troubles with the built-in electric motor even if a water-containing hydraulic oil or aqueous hydraulic oil is fed and discharged.

4. MATHEMATICAL MODELING

Mathematical modelling is very important to define specific parameter and standardizing. In industrious, volume of tiles has calculated by using size of tiles which is in standard form. Flow rate also get for one minute with the help of formula;

$$Q = V / T$$

Generally power is also calculated for hydraulic motor which is useful to carry oil and moreover capacity of tank has taken in account. As according to design, minimum pressure of the system 5 bar and Maximum pressure of the system is 7 bar. Hence it should be vary in operation. Diameter of delivery pipe should be 6mm.

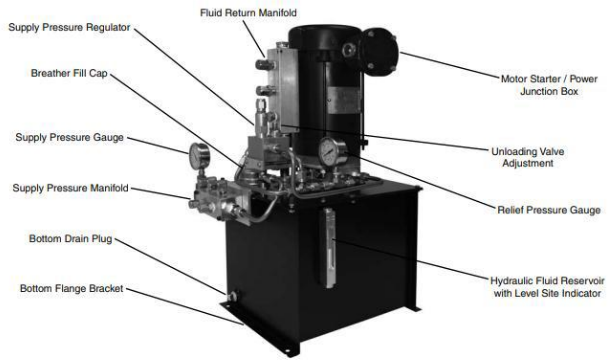

Fig. 4.1 Assembly

For preliminary design of our model "Automatic oil filling pump" we use following element design with dimensioning and by efficient use of standardization and availability in market. The component which are mainly considered in the design are as follows.

1) Base oil box.
2) Upper cast iron plate
3) Electric motor (5 HP)
4) Oil pump (2 LPM)
5) Pressure gauge.
6) Pressure control valve.
7) Piping arrangements.
8) Fastener assembly
9) Non return valve.

5. ASSEMBLY ANALYSIS

Our assembly is basically divided into three main parts as follows.
1) Base assembly
2) Component arrangement and assembly.
3) Fastener assembly
Firstly, in base assembly we join the base oil box with the upper cast iron plate for that we use bolt fastening method as shown below.

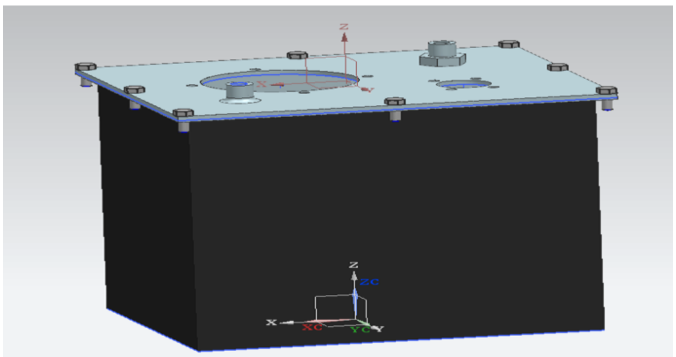

Fig. 5.1 base assembly

Secondly, On the surface of upper plate mount electric motor, pressure gauge and pressure control valve as shown here, then piping arrangement is done manually in that model as follows;

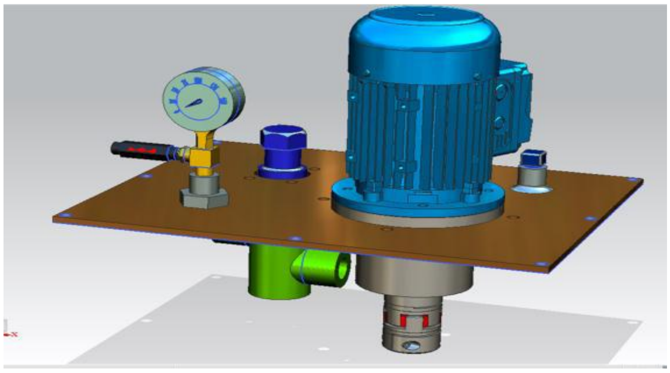

Fig. 5.2 component arrangement and assembly

For fastener assembly we use HEXA BOLT with diameter 8 for fastening the base oil box and upper plate, and we use the bolt for 12 diameters for fastening the other component with plate.

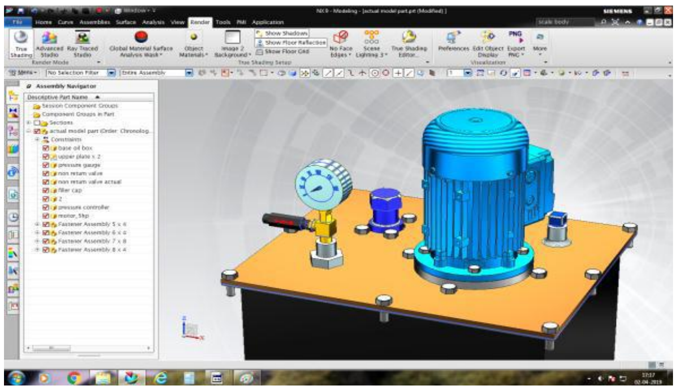

Fig. 5.3 fastener assembly

Finally, we set up all three assembly with the help of various equipment. It can be applicable for ceramic products to punch press in manufacturing industrious. We have to analyze this operation before put in application so that we use NX NASTRAN software for simulation of our base oil box along with the upper cast iron plate. We use 3D tetrahedral mashing with 1D connection at the point of impact of motor load. Multifarious load is also possible in between operation due to having pressure assembly but it has huge potential to give always positive response in every situation. Here is some snapshot with complete analysis report.

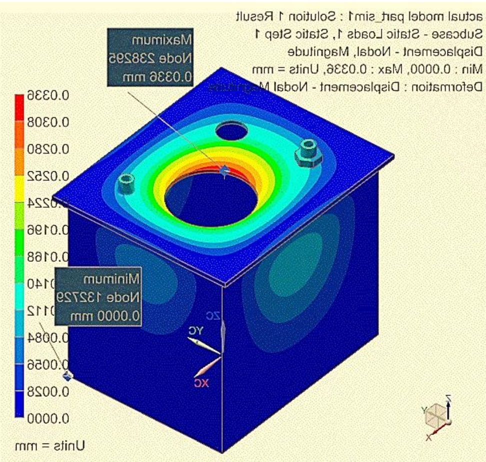

Fig. 5.4 software simulation

6. CONCLUSION

Finally, the efficient work from Project I research, and from the work towards the prototype making in Project II, Now we have completed the solution for which we are designing the “Automatic Oil Filling Pump”. In Project II we make Software Design, Software Solution and Actual Prototype with working validation in industries. Now Project is complete and is efficiently working in the “Prime Industries” Where also implement our project. Therefore we can say that the industries where similar kinds of requirements can use our product for their Industrial application.

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