Design Consideration of Oil Measuring & Dispensing Machine

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Abstract

Liquid dispenser machine is commonly found in our daily life in different places like offices, bus stands, railway stations, petrol pumps. In this thesis we are going to present a pneumatic operated oil dispenser machine. Using a pneumatic system interface, we can effectively increase operator accuracy, reduce training time and improve overall efficiencies, thus keeping cost down a properly designed pneumatic system interface can improve overall accuracy. Present liquid dispenser machine available in industries are costly, complex and hard in design and fabrication. Main requirement from this machine is its metering or measuring quality. Accuracy of measuring is very less in various machines. Hence, the basic theme behind this research is to improve these disadvantages of oil dispenser machine. The oil dispenser machine presently available is based on practice and past experience of the employer in his working field and also, its efficiency declines at a greater rate after a period of time. By surveying the present machines and comparing their present limitations, new model will be fabricated so that designs data can be obtained to formulate experimental data based model for this process. The design of model will be so simple that it can be adopted easily by small industries & automobile workshop. Easy technology will help to reduce metering problem. The present work reports the design & fabrication of oil measuring & dispensing machine which is used in small industries & automobile workshop.

Keywords: Oil Dispenser Machine, Relays, Solenoid Valve, Pneumatic Actuator & Air Compressor

I. INTRODUCTION

Liquid dispenser machine is widely used in all industries like liquid filling machine, bottle filling machine, paint industry, etc. Liquid dispenser machine is commonly found in our daily life in different places like offices, bus stands, railway stations, petrol pump. In our day to day life, we come across the measurement of oil for our two/four wheeler. Many a times we have come a cross the situation were the quantity of Oil dispense to the Oil tank will not accurate. As the measurement of oil is done by standard oil can and oil is dispensing from the barrel by rotary hand pump which does not measure the oil. I have decided to do this project which will measure the oil and dispense the oil from the Oil barrel accurately.

As the rate of the oil in standard packing is 30-35% more than that of oil of same grade in 210 liter barrel. But in present situation use of barrel oil in garages is very less, because of hand operated rotary dispenser which dispense the oil only and it does not measure the oil. Also there is wastage of oil by using this conventional oil hand operated rotary pump. Due to this several disadvantages garages are not using the barrel oil which is 30 to 35% less in cost as compare to standard packed oil in small packing of same grade. In present situation consumer has to pay 30-35% more money of same grade oil by using the standard packing oil.

II. DESIGN CONSIDERATION

A. Specification of Pneumatic Cylinders

Following points need to be considered while selecting a pneumatic cylinder

- Cylinder thrust.
- Air consumption.
- Piston velocity.
- Couplings.
- Cylinder Thrust

The cylinder thrust is a function of:

F = Cylinder thrust in Kg.
D = Dia of piston in cm
d = Dia of piston rod in cm.
p = Operating air pressure in "bar".

Thrust exerted by various type of Cylinders:

1) Single acting push type:

$$F = \{\pi/4 \times D^2 \times P\} / 4$$

2) Single acting pull type:

$$F = \{\pi/4 \times (D^2 - d^2) \times P\}$$

3) Double acting in forward stroke

$$F = \{\pi/4 \times D^2 \times P\}$$

4) Double acting in return stroke

$$F = \{\pi/4 \times (D^2 - d^2) \times P\}$$

B. Air Consumption

The air consumption data for a cylinder is required to estimate the compressor capacity. The calculations include air consumption during forward as well as return stroke. The free air consumption for forward stroke is calculated as follows:

Free air consumption = piston area x (operating pressure + 1.013) x stroke

The free air consumption for return stroke is also calculated similarly and added to arrive at total free air consumption of cylinder during one complete cycle.

Theoretical air consumption calculations:

Let D = Dia of piston in cm.
d = piston rod dia.
L = stroke in cm.
P = Air pressure in bar
Free air consumption in litres for forward stroke
$C = \{\pi \times D^2 \times (P+1) \times L\} / 1000$
Free air consumption in litres for return stroke
$C = \{\pi \times (D^2 - d^2) \times (P+1) \times L\} / 1000$

C. Piston Velocity

Factors governing the piston velocity are: the operating pressure, opposing forces, inside diameter and length of the air line between the control valve and cylinder and the size of the control valve. The piston velocity may be increased or decreased with the help of a quick exhaust valve or flow control valve respectively. The average piston speed at no – load is between 100 – 500mm/ sec. Depending on the frequency of operation and the speed required, proper type and size of valve needs to be selected.

D. Flow Measurement

The selection of valve for any automation, needs to be evaluated in terms of its flow rate to determine its capability to meet the final application. Flow rate is defined as the volume of air passing through given cross section in a unit time.
Typical unit for measuring flow rate is Nl/m (i.e.. Nominal litres per minute) or SCFM (standard cubic feet per minute) expressed at standard conditions of pressure and temperature.

E. Flow coefficient (Cv)

Cv is a measure of flow capacity. It is measured as the flow of water through the cross section of the valve in US gallons (3.785 litres) per minute when the pressure differential is 1 psi. Flow rate in litres/sec thro' a valve can be calculated to a limited accuracy by the formula:
Air flow rate (litres/sec) = 6.694 Cv(outlet pressure + 1.013) x P
Pneumatic valve selection
To select a valve, following details need to be taken onto account:

- Cylinder bore (D cm)
- Stroke of cylinder (L cm)
- Required stroke time (T sec)
- Pneumatic pressure available (P)

Constant "M"compression factor can be substituted in the formula below:

$$Cv = \frac{\text{Cyl. Area x stroke x M x compression factor}}{475 \times \text{stroke time in sec.}}$$

Selection of valves
The following parameters need to be considered for selection:

- Internal construction and other features
- Valve capacity

III. OBJECTIVE

The main aim of this project is to overcome the traditional method.

- To Design & Fabrication of oil measuring & dispensing machine for workshops, automobile garages and industry.
- Oil measuring & dispensing machine has been developed using pneumatic system, solenoid valve & non return valve etc.
- It has wider application in automobile garages, workshop and industry.
- Our aim is to use of barrel oil in big to small automobile garages so that consumer can get oil in low rate as compared to standard small packing tin rate.
- After Designing of low cost oil measuring & dispensing machine, the performance of the machines will be tested for commercial applications. If performance is found satisfactory, the machines would be used for commercial applications
- To develop a low cost machine so that it can be easily used in automobile garages, workshops & in industry.

IV. CONCEPT

Introducing low cost automation was to overcome problems with the current manual traditional method. The concept of the work is,

1. Observe the manual methods to identify the important process variables.
2. Quantify the important method.
3. Develop a model automation system which could control over all of the process.
4. Investigate all areas of automated forming.
5. Produce a specification for a low cost automated system.

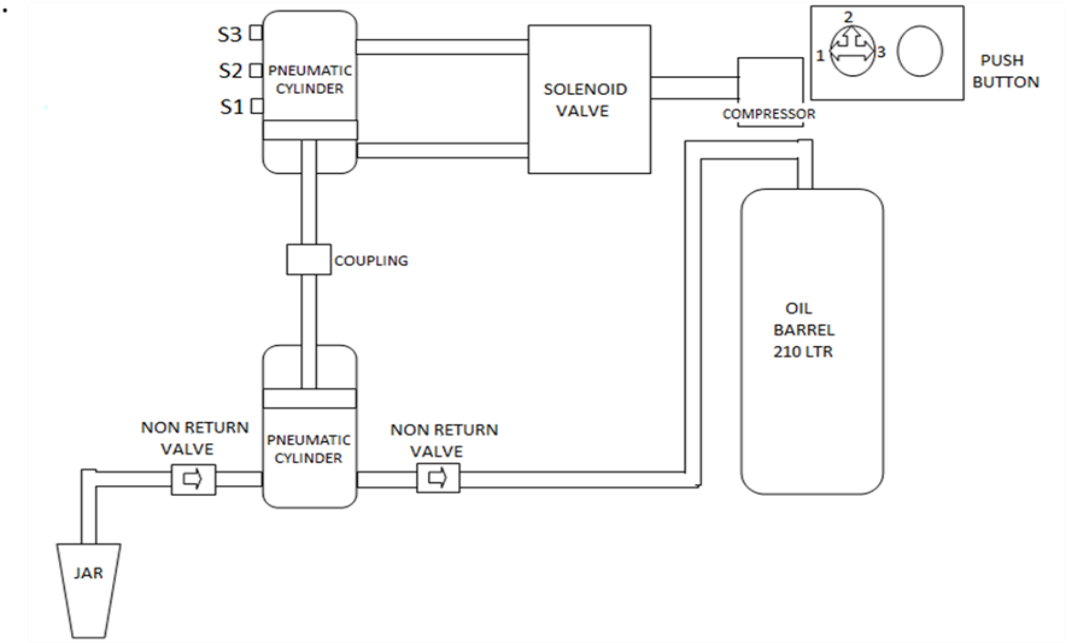

Fig. 1: Design and Fabrication of Oil Measuring and Dispensing Machine Schematic Line Diagram

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