Design and Fabrication of Hydraulic Operated Food Processor

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Abstract- *The proposed project work carried out in YOGESH ENTERPRISES. Even there is a large demand in the market for fast-food ,the company not able to meet the demand by the manual production process. Automation is a step beyond Mechanisation, to increase productivity and to improve the quality. Automation involves, very minimum labour involvement in work. As per today's scenario, many Industries trying to develop automation on different levels of production. The project aim is to reduce the manpower and increase the profit by increasing the production and quality. And also reduce the material wastage of manual handling. Automated fast food machine is a device that press the duff mixture of fast food by hydraulic pressing circuit.*

Keywords- Hydraulic food processing machine, Hydraulic circuit calculation, cylinder pressure, Catia

I. INTRODUCTION

The automation of manufacturing plants has been actively pursued for more than 50 years. And it will continue to be so, even more aggressively, during the next 50 years. The increased zeal in industrial automation is mainly due to the explosive growth in computer hardware and software technology. As computer invade a high level of automation in every facet of the manufacturing processes. The automation always gives fruitful results in industry

This fast food making device is commonly made with a handheld hand-made wooden device consist of a small cup have a cylindrical through bore extend from its top to bottom. The device is operated by placing the dough mixture into the cylindrical tube of the cup and then inserting the plunger into the cylindrical tube and squeezing the grips of the plunger and the cup tightly towards another by hands so as to extrude the dough through the plate with the plunger to the different form
The application of fluid power requires some type of fluid circuit. Many different circuit designs are possible for a given application. However, most hydraulic circuits represent some variation of a few basic circuit designs such as pump circuits, fluid motor circuits, accumulator or intensifier circuits, and control circuits.

II. LITERATURE REVIEW

Ramesh Kumar K R et. al (June 2014) The proposed project work carried out in ID Fresh Food (India) Pvt. Ltd. Even there is a large demand in the market the company not able to meet the demand by the manual production process. In this project the cooking process of the parota production is aim to automate. By this project aim to reduce the manpower and increase the profit by increasing the production and quality. And also reduce the material wastage of manual handling.

Wael M. Elamin et. al (2015) High pressure processing (HPP) is an interesting non-thermal technology that involves the sterilization of food by the mean of ultra-high pressures, which lead to extending the shelf life of processed food, as well as maintaining nutritional value and quality of food products. The consumers' increasing demand for this new products graped the interest of several already-existing high pressure equipment manufacturers around the globe. The successful of this technology encouraged them to enter the field of food processing and adjust their existing technologies to adapt to the new process.

K. S. Shaji et. al The aim of the paper was to 'Design and Development of Automatic Dosa Maker for Indian Households' by considering cost, usability, safety, easy handling and hygiene. Dosa is an unavoidable food item in most of the South Indian households. During the research some simple traditional dosa making method were studied and adopted for concept selection and mechanism. Market study was conducted to understand the current dosa making methods, and several dosa making machines were studied in this market study.

III. PROBLEM STATEMENT

In the competitive fast-food industry, fast-food restaurants have to maintain efficiency in their standard operations and keep up with the quality of their products and services. However, we think that there are some issues concerning the traditional way to order food in fast-food restaurants.

Fig.1 -Conventional Machine or Instrument

A hydraulic food processor is to be designed analytically for the medium scale industries for increasing the production. Material used for the structural parts is ST-52 series steel with yield strength of 280-350 Mpa and for food jar the material used is AISI 302. The dough material handled by the jar of 3-4 kg.

IV. DESIGN OF HYDRAULIC FOOD PROCESSING MACHINE

In design method, firstly we understand the problem statement. Then we find various solutions to overcome the problem and how to automize the operation.

The difficult task of designing is that to design the various component of the hydraulic circuit then on that basis we made various conceptual rough drawings of machine.

Then we discussed the drawings with design engineers of that company and at the end we finalize the design. We made basic model of machine of rough drawings on the designing software catia

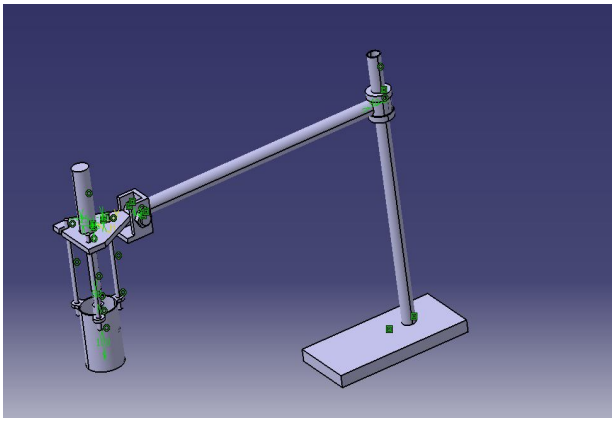
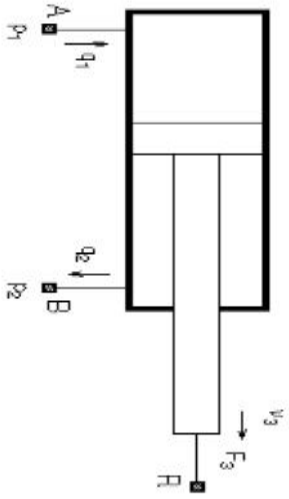


Fig. 2-Dimensional View of Machine Assembly

V. CALCULATION FOR MAXIMUM FORCE (DYNAMIC)



$F = ma + A_d P/10 + mg*\sin\alpha - f$

(for inclined or vertically downward direction of mass)

Where:

F = total force acting on the cushion chamber in Newton.
m = mass of load in kilograms (including piston, rod, and rod End accessories)
a = deceleration in m/s2, derived from the formula

$a = v2/2s \times 10\text{-}3$

Where:

v = piston velocity in m/s
s = cushion length in mm

Ad = area acted on by pump pressure in mm2 (select std. area)
P = pump pressure in bar

g = acceleration due to gravity = 9.81m/s2
α = angle to the horizontal in degrees
f = friction forces in Newtons = mg * 0.15

By considering mass of all accessories = 20 kg
a= v2/2s * 10-3
v= 1.5 m/min= 0.025 m/sec
s= 22*10-3…….(Ref. parker catalogue)
a= (0.0252)/(2*22)*10-3
a= 0.014 m/sec2
Ad= 2020 mm2
P= 25 bar
α= 90o
Friction coefficient= 0.15
F= ma + Ad P/10 + mgsinα -f
=20*0.014+(2020*25)/10+20*9.81sin(90o)-(20*9.81*0.15)
= 5217.05 N

The total deceleration force is developed by the fluid compressed in the cushion chamber. This pressure is approximately equal to the Force divided by the annular area (cylinder bore area - rod area):

5217.05÷(2020-956.62)= 4.906 N/mm2 or 49.06 bar

VI. FUTURE SCOPE

Now industries are being replaced by Automation and robotics. All process and work are carried out by machines and robotics process automation. Every industrial sector like manufacturing, process industries, chemical, food & beverages, Oil Gas , Transport, machine tools everywhere Industrial automation is used. Hydraulic food processor can be use in industries for automation. Project also improves the quality of food, and increases the productivity of food.

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REFERENCES

[1] Jijo k j , Ramesh Kumar K R. , “Process Automation For A Food Processing Plant ”, international journal of science, Engineering and technology Research (IJESTR), Volume 3, (6 JUNE 2014), 1744-1749
[2] Wael M. Elamin, Johari B. Endan, Yus A. Yosuf, Rosnah Shamsudin and Anvarjon Ahmedov., “High Pressure Processing Technology and Equipment Evolution: A Review ”, Journal of Engineering Science and Technology Review -8, (2015), (75-83).
[3] Yuken Hydraulic Equipment Catalogue, Yoken Kogyo Co., Ltd. Japan.
[4] Fluid Power System, “Dhanvantari College of Engineering, Nasik 5.Engineering Design Handbook For Hydraulic System,” Headquarters, U.S. Army Materiel Command”(15 April 1971).
[5] Parker hydraulic cylinder catalogue HY07-1130/UK May 2003