PROJECT REPORT

DEVELOPMENT OF AN AUTOFILL MACHINE

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INTRODUCTION

The machine made is a prototype of a machine that is designed to simplify the process of filling food into cans, therefore the materials used are not the required food-grade materials that are inert, non-corrosive and suitable to come in contact with food during the filling process.

PROBLEM DESCRIPTION

When filling has to be done manually after food processing, there is a lot of inefficiencies. Manual filling involves dipping jags into the vessel containing the processed food, scooping and pouring the contents into the cans in approximately equal measures. The jag is then put aside on a table as the lid is applied onto the can, then the process is repeated. In some large scale industries, the food is pumped up to an elevated vessel so that the product continuously flows by gravity through valves to the tins held by people just below the outlets, one after another.

Both processes have some shortcomings:

- There are high chances of physical contamination which can be a health hazard
- The process is slow and involves high costs of labour
- The quantities filled is not precise, since the process involves excess filling followed by reduction to approximate levels
- The process is not safe for the labourers when the products are filled at high temperatures
- A lot of wastes due to spillages
- The products that need to be filled hot cool over time due to exposure to the surrounding temperatures
- Fatigue causes under-performance of the workers

JUSTIFICATION

As opposed to manual filling, the non-powered auto-fill machine will be able to fill with the following benefits

- Reduced chances of physical contamination
- Precise filling
- Automatic and fast hence reduced costs of labour
- Auto-counting
- Reduced cost of energy compared to other filling machines
- This is a machine that simple and reproducible. It is local, uses material that is cheap and available.

OVERALL OBJECTIVE

- Coming up with a machine that fills automatically, precisely, hygienically and counts the number of cans filled, all at the same time.

SPECIFIC OBJECTIVES

- To accurately develop the appropriate dimensions and shapes for specific parts that can be assembled to make the machine
- To be able to make the specific parts that can be used as visual demonstration of the real function of the actual part in the machine
- To be able to use the available materials to make the machine, assemble and test for efficiency
- to be able to develop the machine according to the plan specified and within the stipulated time, then later making the necessary changes to ensure efficiency.
- To be able to work with the developed drawings for the machine parts

SAUCE LINE FLOW CHART

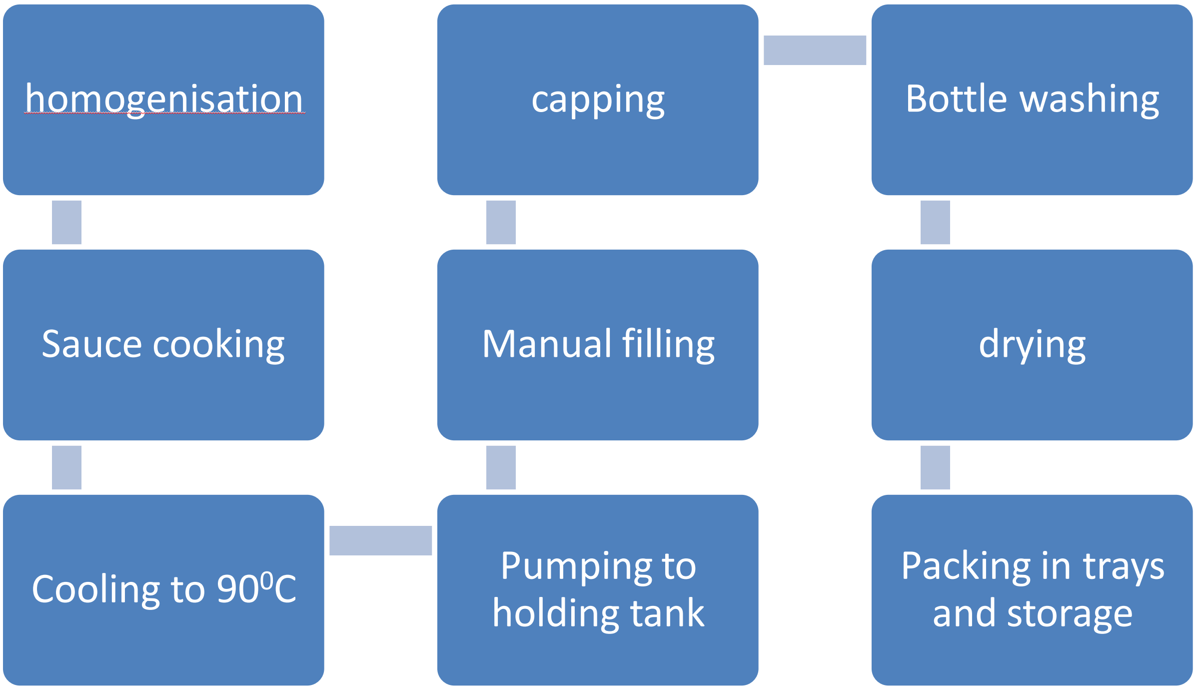
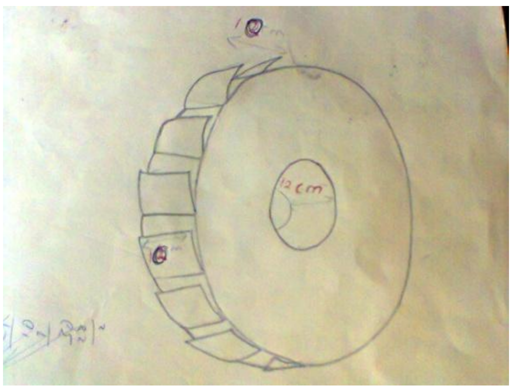


Fig 2: Sauce line flow chat

DESIGN

TURBINE

- Internal diameter 12cm
- External “ 24cm
- Plate dimensions 10cm by 10cm



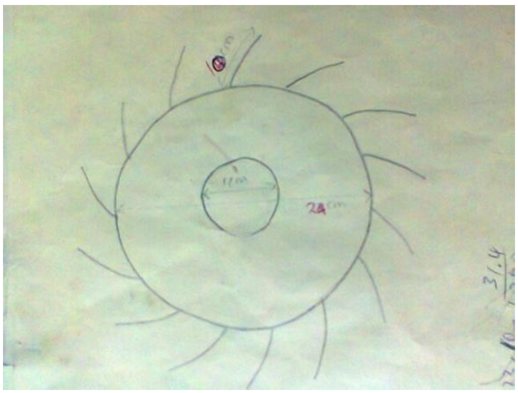


Fig2a: Turbine front view

fig2b: turbine side view

The counter

In this design the demonstration of a counter will be done using a calculator.

- A shaft that connects the valve cam to the counter and presses the counter on every protrusion and the figures on the screen keep adding up.

Fig3: the counter

The turbine compartment

- The turbine is set in a way that the force of the fluid causes a torque on is hence causing a rotary movement. A shaft runs through the center and rotates with the turbine

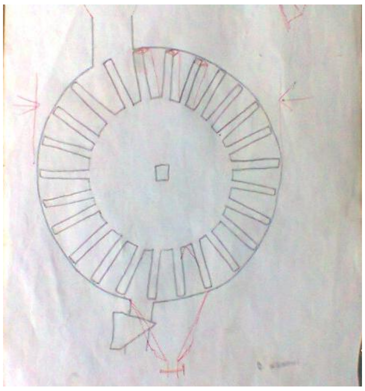
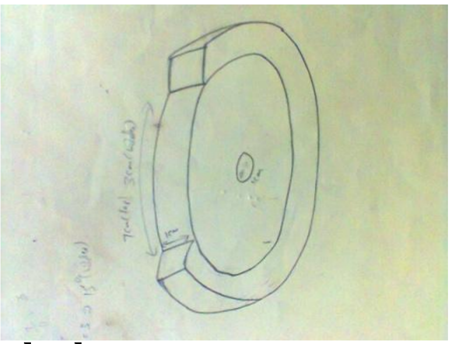
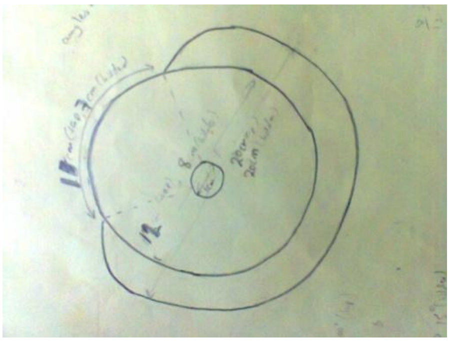


Fig4: turbine in its compartment

The cams

- They are circular disks with off-centers or protrusions. A bearing connected to a shaft moves along the edge of the cams.





Fig

The body

- Consists of two compartments, one with the turbine and the other with the cams. This is designed to improve hygiene by limiting contact of food to other materials. The upper compartment has the inlet.

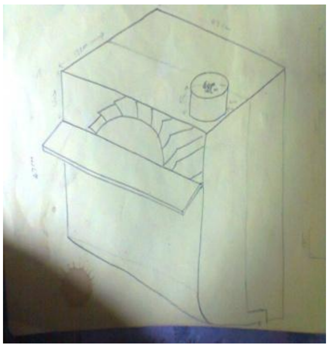
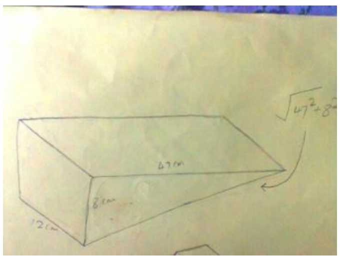


Fig6: the body

Base collector and valve

- It is slanted to avoid accumulation of food remains in the compartment. All food flows towards the outlet



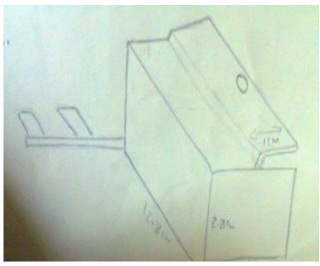
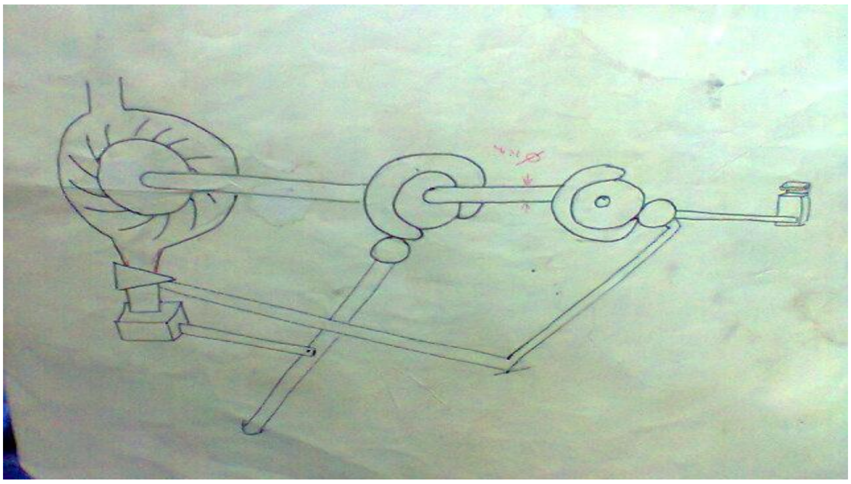


Fig7: the collector

fig8: the valve holder

The system

The turbine has a shaft that runs through the center, and through both compartments. The ends are force-fitted to bearings that are attached to the body. The body has stands that elevate the machine off the ground. The turbine is fit in the compartment containing the food inlet. In the rare compartment, two cams are fixed such that as they rotate with the shaft, the protrusion of one cam passes a fixed point earlier than the other and the end of the protrusion of the same cam passes the same point later than the end of the other. This cam is connected to the valve that delivers can to and from the outlet. The other cam is connected to two shafts, one connected to the counter while the other is connected to the valve. The base of the system consists of a slanting wedge that leads the food material to the valve only, and the outlet system that also contains the valve holder.



FORMULATION

The amount of the product required, SKU, depends on the following factors:

- The velocity of the incoming fluid, *v*
- The speed of the rotation of the turbine, *s*
- The circumference of the protruded section of the cam, *c*
- The diameter of the outlet, *d*
- Fluid density, ρ

- SKU is directly proportional to *vcdp/s.* an approximate test for small scale use pf the machine is as follows:

FOOD	WATER
SKU	500g
Food flow rate	150g/s
Time to fill a cup	2s
Number of cups	8
Total time for turbine rotation	16s
Length of valve-connected cam protrusion	20cm
Total time of valve opening	12.5s
Rate of discharge	500g/12.5s

COMPARISON

Filling comparison

<u>manual</u>

- Cooking
- holding tank
- scooping
- Filling by many people
- capping

- can washing
- Drying
- storage

<u>auto-fill</u>

- Cooking
- Filling automatically
- Capping by single person
- Storage

Requirement comparison

<u>Manual</u>

- Labourers need to be many women to fill, can and wash the cans
- Can washing is needed to wash out spillages on the cans

<u>Auto-fill</u>

- One labourer to can and monitor the machine
- No spillages hence no can washing is required

CONCLUSION

- The machine development was successful. It works according to the specification and design

SUGGESTIONS

Such machines can be used as conservers of energy if the heavy machinery currently used could be replaced with a modified version of the non-powered auto-fill machine. This modification could involve making multiple tap outlets, introducing small currents for the control of the valves and can delivery, the turbine shaft extension connected to an automatic capping system, etc. further improvements and modifications are necessary