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Governing for Glue Distribution Head

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Abstract: *This project is industry sponsored project. The industry is Sarvin Printers Pvt Ltd. [1] It is a Private incorporated on 24 August 1984. It is classified as non-government company and is registered at Registrar of Companies, Mumbai. It is involved in Printing and service activities related to printing. Such as paper bags, paper plates, etc. Along with this they also print the paper bags required by different well-known companies such as Amazon, Flip kart, etc.Sarvin Printers Pvt. Ltd. Situated in Nashik MIDC. This was a case study-based project as well as a design and development-based project. As the industry had some mechanical and non-mechanical problems, we studied these step by step. The industry manufactures simple paper bags for various companies. To make the production more efficient they required somewhat optimization. In order to do this a team was formed. Our task was to understand the initial process carried out in the industry and suggest a more efficient design for the same.*

Keywords: *Sarvin Printers Pvt Ltd., Design and Development, Case Study.*

I. INTRODUCTION

The problems identified were on different stations such as, the calibration station, the ink applying station and the glue distribution and applying station. Of course, the most severe problem was with the calibration station as it required much more man power as compared to other stations. In this unit the cross checking of paper bags is carried out. As mentioned above, to check for the errors regarding the adhesive or printing, this unit plays an important role. Currently they are manually cross checking these paper bags. This requires a lot of manpower, because on an average there are 2 paper bags manufactured per second. This problem had many sub-causes which made it a bit difficult to solve. Thus, we focused on the glue distribution problem.

II. PROBLEM STATEMENT

Fig. 2.1

As shown in above fig. 2.1, the process is of glue applied on a white band to be glued on one side of brown paper. There are two steps or stations in which glue handling is required. First is shown in above fig. the second one is when the two brown papers are to be glued together. In the second station there is a problem of glue overflowing, and glue not sticking properly. The arrangement was such that, there was a tray on which the glue is poured manually. In this tray there are two rollers, which are connected to each other by a shaft, they are rotated. And by doing so the glue from tray gets glued on the rollers circumference and gets applied on the paper. The problem of overflowing had some solutions. The first was to increase the length and width of the tray so that the space between the rollers and the tray is reduced or eliminated, which was also a cause in overflowing.

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The second solution was to provide an overhead tank in which the glue can be stored and supplied as per requirement. The connection between this tank and tray should depend on the glue level in the tray, hence a governing device was required.

III. PROBLEM SOLUTION

The main task was to identify the type of mechanism. Whether to use a rotary or linear actuation method, the type of pair if gears are to be used. Another major task was to identify the actuating technique. The adhesive level in tray was the main element, without which the system won't work. But if we designed this system similar to the float, there would have been chances of the float not staying on the surface of the adhesive. It would have sunk to the bottom. Hence first we took into account the buoyancy force of the adhesive.

Next step was to finalize the design part. For this we had come up with some layouts, the very first consisted of gear pairs with gear ratios to magnify the input, a lever, an internal threaded pivot and an external screw. Later this design was enhanced and a much simpler design was developed.

As shown in above fig. 3.1, the arrangement now consists of only a few elements. They are rack and pinion arrangement, a float, a lever, a shaft, a pulley and a wire string.

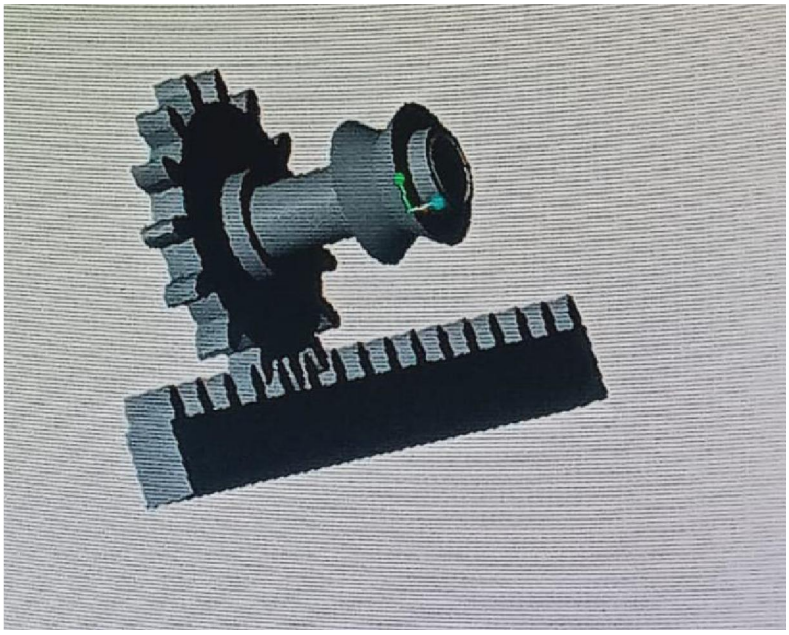

Fig. 3.1

IV. CONSTRUCTION AND WORKING

A) Construction

1. The float is placed on the glue in the tank.
2. This float is connected to the levers one end. The other end of lever is connected to the rack.
3. This rack is in mesh with the pinion. As the rack reciprocates its linear motion gets converted into rotary motion with the help of pinion.
4. The pinion is mounted on a shaft which will rotate along with it. There is pulley mounted on the shaft.
5. As the shaft rotates the pulley also rotates. There is a wire coiled on the pulley. This wire is further connected with the valve.
6. As the pulley rotates the wire either pulls or releases the wire string.
7. This whole assembly is in a closed box. This is box compact in size as there is not much space around the tray.

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B) Working

Two cases are observed

a) Case No. 1: - The glue level in the tank has dropped.

In this case, the float on top of the float will move downward. Dur to this the lever will also move downward. The levers other end, hence lifting the rack. The rack will move upward and because of the meshing of rack and pinion, the pinion will get rotated. This rotation will be given to the pulley with the help of the shaft. The wire which is surrounded on the pulley will get stretched, hence pulling the valve. The valve will get opened and the glue form overhead tank will start to flow in the tank.

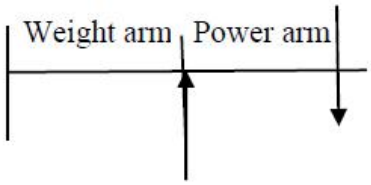
b) Case No. 2: - The glue has reached its max limit inside the tank

In this case the float will move upward, pulling the lever. The levers other end will move downward, along with this the rack will also move down. The pinion, in mesh with the rack, will rotate in the opposite direction now. This is given the pulley with the help of the shaft. The pulley will also get rotated in the opposite direction. This will cause the string wire to release the valve. Once it gets released the flow from overhead tank will get cutoff, and hence there will be no supply of glue to the tray. And there will be no overflowing of glue from tray.

V. DESIGN

1) Design of Float

Total buoyant force (upward force) = weight of body= weight of the fluid displaced
= density of fluid * gravitational acceleration* volume of fluid displaced



2) Design of Lever

Taking moment about fulcrum 'f'
P*AF= W*BF
W= Buoyant force

3) Design of Rack

a) Pc= Circular pitch = (3.14 * D) / T
Where D= Dia. Of pitch
T= no. of teeth
b) Diameter of pitch= T/D = 3.14/ Pc
c) Module = D/ T
d) Gear ratio = TG/ TP= DG/DP = NP/NG
e) Minimum no. of teeth on rack=
T= (2*Ar)/ (sins2 * pressure angle) [4]
f) Minimum no. of teeth on pinion =

$$Tp = \frac{2 \text{ X AW}}{G * \left(\sqrt{1 \text{ x } 1/\text{ G } (1/G + 2) \sin^2 \text{pressure angle } -1} \right)} \quad [5]$$

Where g= Gear ratio

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Aw= 1 module
g) Distance between centres =DG/2 + DP/2
h) Module= DP/TP
i) Pitch circle diameter = Dp = m* Tp

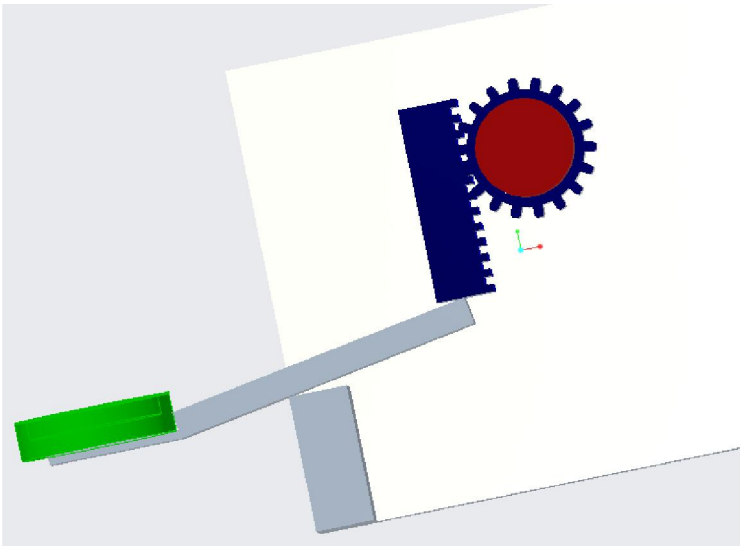

Fig. 5.1 Final outlook

VI. ADVANTAGES AND DISADVANTAGES

A) Advantages

1. No need of external input from worker.
2. Provides safety to the workers.
3. Small in size
4. Lightweight
5. Easily portable from one place to another
6. Provides clean surroundings.
7. Cost efficient
8. No power is consumed

B) Disadvantages

1. If the string wire breaks, there can be chances of overflowing or no glue will be supplied to the tray. Hence production is hampered.
2. Without guidance no one can change the movements of the inside mechanism.
3. If the glue by chance enters this mechanism, there is chance that components will not be able to move as they will get stuck due to glue.

VII. FUTURE ASPECTS

Although this project is purely mechanical based, we do suggest that in order to enhance this mechanism more we can implement an electronic system. The initial cost might be slightly greater than the mechanical one, but it will surely increase the efficiency of the mechanism. Also, as it is an electronic system, there will be very minimum chances of errors.

The system will consist of same working principle but except for the rack and pinion arrangements, we can utilize the sensors and motors. Again, this will be self-propelling mechanism.

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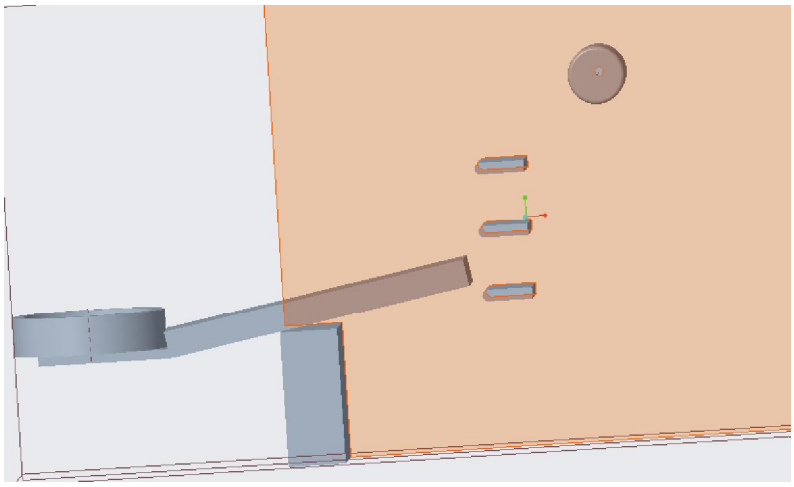

Fig.7.1

As shown in above fig.7.1, there are 3 sensors situated near the lever, indicated by the small rectangle shapes. These sensors can be proximity sensors. The input to this sensor will be the lever, and the output of it will be given to the motor. Indicated by the circle at the top right corner. Once the motor receives the input, it will start to rotates by a small amount. Hence releasing ore tightening the string wire connected to the valve. The motor can change directions depending upon the input signals.

VIII. CONCLUSION

As mentioned in the above points, we are have worked on different systems to achieve the required design which will fit correctly in our budget and also perform the task with accuracy and precision. Along with this we will have also tried to fix some other problems. As the industry is investing in us, we are required to give the expected out come as well. The whole process of finalizing the design made us change the design a few times, to optimize the process.

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