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Hopper mechanism for powder food packing industry

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ABSTRACT

The hopper mechanism is completely mechanical, so the stability is very high compared to the electronics hopper. The hopper is a pyramids structure where a slot is provided in the bottom centre, for the flow of the food powder. Beneath the hole in hopper a sliding plate is placed for opening and closing of the hole so whenever the sliding plate moves food power drops from the hole to the packet. After the weight reaches a particular level the plate closes automatically. This is done by a spring mechanism according to the stiffness of the spring. The spring is attached to a plate where the food powder falls in. When the weight of the food powder exceeds the stiffness of the spring then the plate connected with spring moves up. So, the sliding plate covers the hole so that the flow of food powder has been stopped. Then the powder food product flows in a packing bag so that each packet can be sealed using a sealing machine.

Keywords— Hopper, Stiffness, Sliding Plate

1. INTRODUCTION

In advancement in the packing industry many types of electronic feeders are used for packing the food products. But in small scale industries the packing is done manually since the cost of the hopper increases. So, the hopper which consists of mechanical setup can be easily maintained and it is very stable. The main reason for the mechanical hopper is to increase productivity of the small-scale company. By implementing the mechanical hopper in a single setup six to eight packets can be sealed at a time. By using electrical parts, the cost of the overall setup increases so the cost of the product also increases. The hopper consists of two guides below the spring mechanism where the sealer is placed, the sealer can move top to bottom along the guide. When the packet is filled with the powder food product at a particular weight then the packets are sealed by using the sealer.

2. DESIGN OF HOPPER MECHANISM

The design of the hopper is based upon the total number of packets that can be sealed at a particular weight. The shape of the hopper is in the form of pyramidal shape so that the flow of the powder is smooth enough. The size of the hopper is 300 mm x 300 mm in the top and in the bottom a hole of 15 mm is drilled for the flow of the food powder. The plate which holds

the spring measures a size of 100 mm x 100 mm. The spring used here is a helical.

Calculation

Stiffness of helical spring

$$K = Gd^4/8D^3n \text{ N/mm}$$

Where

K - Stiffness

G - Shear modulus in N/mm² (for steel material 79300 N/mm²)

d - Wire diameter in mm (2.5 mm)

D - Spring diameter in mm (20 mm)

n - Number of turns (18)

$$K = 79300 \times 2.5^4 / 8 \times 20^3 \times 18$$

$$K = 0.7 \text{ N/mm}$$

3. FABRICATION OF THE HOPPER

The hopper is made up of aluminium sheets metal by welding the corner of the sheet to form a pyramid structure. The guide in which the sealer moves up and down is by hollow aluminium pipe since the weight is less. So it is more stable for holding the sealer and the hopper. The hopper is paced on a stand which is welded on top of the guide bars to support the hopper. The welding used here is arc welding since it is of low cost and highly reliable and the hopper does not require much weld strength since there is no heavy load acting on the point of weld.

4. IMPLEMENTATION

Initially the base of the hole in apparatus is made in a square section rod to withstand heavy load.



Fig.1: Spring mechanism

Above that the guides are attached by welding process, then the sealer was inserted into the guide ways so the it can move top to bottom. At the other end of the guide ways an elliptical support is made to hold up the Hooper in position.

5. WORKING

Initially the food powder is stored in the hopper and it is allowed to flow through the hole, then the food products collects in a tray connected to the designed spring below the hole in the hooper. When the weight of the product exceeds the stiffness of the spring, the food powder pours down in the packing packets. Simultaneously the sliding plate below the hole now closes the hole and does not allow the product to flow. When the product in the tray completely flows into the packet for packing then the sliding plate allows the food powder to flow through the hole into the packet, then the next packet is sealed. This process continues until the powder in hopper is completely packed by the sealer present in the guide ways.

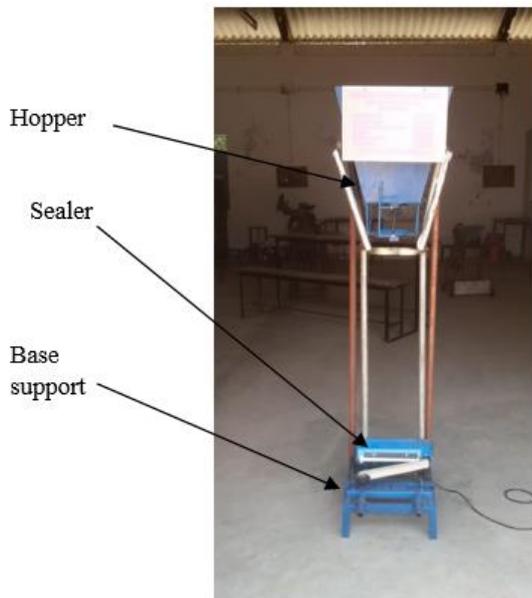


Fig. 2: Hopper setup

6. CONCLUSION

The hopper mechanism is completely made up of mechanical component so the reliability is very high. The basic purpose is to increase the productivity of a small-scale food packing industry. The manufacturing cost of the hopper is very less compared to other hoppers in the market. It further also reduces the labor cost in a company so the profit gradually increases.

7. REFERENCES

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