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Automatic Parts Transferred from Grinding Machine to Deburring Machine

Adesh Kakad[1*], Ashish Jadhav[2], Nikhil Kedare[3], Shubham Ikhe[4], Y. B. Chaudhary[5]
[1,2,3,4]*Student, Department of Mechanical Engineering, Maratha Vidya Prasarak Samaj's Karmaveer Baburao Thakare College of Engineering, Nashik, India*
[5]*Professor, Department of Mechanical Engineering, Maratha Vidya Prasarak Samaj's Karmaveer Baburao Thakare College of Engineering, Nashik, India*
*Corresponding author: adeshkakad143@gmail.com

***Abstract*: This is a kind of mechanism that transfers the part between two machines namely grinding machine and deburring machine. Our aim is to prevent coolant which flows at a rate of 10 LPM from being transferred to deburring machine. Simultaneously transferring and feeding of 2 different shapes part through one route with a maximum rate of 2 parts per 5 second. This can be done by using pneumatic energy conveyor or roller. The part is grinded Firstly then its transfer through a parabolic funnel. Then by using pneumatic energy the part is transfer about 0.5 meter and then through conveyor it supplied to deburring machine. Roller is used to feed the part in deburring machine.**

***Keywords*: Part transfer, Grinding machine, Deburring machine, Pneumatic source, Conveyor, Roller feeder.**

1. Introduction

In earlier days parts are firstly transferred through grinding machine and then it should be supplied to deburring machine which is done by a worker. He used to picks that workpiece and then feed that part to deburring machine. Company owner wants to make a mechanism in such a way that the part is automatically transfer from one machine to another. To do that the idea is to collect the part from first machine (Grinding Machine) in a tray then through parabola funnel the part is transfer to the conveyor and then through the circular motion of the conveyor the part is feed to the second machine (Deburring Machine). The other task is to prevent the coolant being transmitted to deburring Machine, but the main task is that the flow of coolant is too high which is about 10 LPM, hence it disturbs deburring operation.

A. Problem Statement

- Part Transfer

The horizontal distance between two machines is about 700mm and the vertical distance is -35mm. the part should be transferred between these distances successfully.

- Coolant

The coolant which is used during grinding operation has so high flow rate which disturbs deburring operation.

- Feed Rate

Normally the speed of component is about 20 parts per minute but the customer wants to design feed rate in such a way that it should allow 2 parts per 5 second.

Fig. 1. Parts to be transfer

B. Objectives

- To prevent the coolant being transmitted to deburring Machine.
- To transfer the part between two machines.
- To feed the part to deburring machine at required feed rate.
- To reduce workload for industrial workers
- Promote productivity
- Material should travelled as short a distance as possible
- Atomized material handling

C. Methodology

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flow of coolant is too high which is about 10 LPM, hence it disturbs deburring operation.

Fig. 2. Methodology

2. Literature Review

Deepak Tarbada et al., [1] have studied different types of ways to transport the material and also listed them. This study has put forward the various factors considered for the design and analysis of AGV based material handling system. The study shows that there is need of further research on AGV based material handling. There is required for cross industry study to make the method suitable for all type of industries. It would be willingly noticed that, with relatively low investments, LCA systems certainly enable the managements to lower the worker's involvement in material handling. This automatically lowers the part rejections, improves safety and reduces accident rate, nurtures productive ambience and contributes significantly to product quality and organizational productivity.

Abhijit Gaikwad et al., [2] According to them Conveyor Belt System for material handling improves the speed of material handling. This system reduces the human effort. The workers are required less and due to which operation cost is reduced and profit get increased. This system is profitable and safety for the material. Also, they have stated that Material handling equipment are designed in such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference. For instance, belt conveyor system can be used for easy material handling beyond human capacity in terms of weight and height.

Vikas Gupta et al., [3] from their study it has been analyzed that material handling is an important process in the industry as it includes most of total product cost. The selection of most suitable equipment for any particular application is very important and it directly affects productivity and efficiency of an industry. Types of material handling systems are discussed. Transportation from one place to another, location & storage material handling equipment are discussed with examples. Also some directions are provided to select the most suitable material handling equipment for a particular application or operation. Thus, the paper concludes that selection of material handling equipment plays an important role increasing productivity and efficiency of the industry and ensures safety of labour and quality of product. The material handling systems are timely delivery the material of required quantity at desired location with maximum safety and at minimum cost.

Nilesh Bodkhe et al., [4] states that high nozzle velocities are always require for conveying the material having high densities like sand & cement. The use of venturi is necessary for balancing velocities & pressure in the pneumatic carrying system.

Catrina Chivu., [5] According to her, there are many comparing points of view regarding the two actuating systems: stiffness, stroke, costs, force, speed, etc. In this paper there is comparison of stroke, dynamic parameters of simulation and forces. Thus, she presented characteristics of the two actuating systems: the advance times and strokes. Even if, from force point of view the results are in favour of the muscle, the dynamic behaviour for the maximum force is less performing.

J. A. C. Martins et al., [6] In this paper they mentioned that distinction between coefficients of static and kinetic friction have been mentioned in the friction literature major contribution to friction science was his elegant application of the general laws of mechanics and the available calculus machinery to the solution of various friction problems, also developed a mechanical model to explain the origins of frictional resistance. In so doing, he arrived at the conclusion that friction during sliding motion should be smaller (one half, he suggested) than friction at the onset of sliding.

B. N. J. Persson et al., [7] In this paper, they discuss the nature of the static and kinetic friction, and of creep. They generally focus lubrication of boundary at high pressure (1Gega Pascal), as it is typical for hard solids, where one or at most two layers of confined molecules separate the sliding surfaces. They find in most of our Molecular Dynamics simulations, that the lubricant molecules are permanently sticked to one of the solid surfaces.

Hamzah M. Beakawi Al-Hashemi et al., [8] This literature review highlights the importance of the angle of repose in a wide range of applications and its ability to describe and assess the macro- and micro-mechanical behaviour of granular materials. The angle of repose has many definitions and methods of measurement, and each of these methods should be used to mimic the granular material behaviour of a particular application.

A. Heinz et al., [9] From their Published a paper we found that Aluminium alloys have wide range of properties like light weight, corrosion resistant, high strength, good fatigue resistant due to this highlighted property of Aluminium alloys we came to conclude that this is the best choice for the stand and column of our project.

Bian Jun et al., [10] Published a paper related to application of Galvanized steel strip from their research we found that galvanized steel strip have wide range of applications also they are corrosion resistant under the action of coolant so it's right choice to select this material for fabrication of tray.

3. Design

A. *Design of Tray*

A tray is a shallow platform designed for the carrying of coolant. It made from galvanised iron material. This tray is also used as a separator which used to separate coolant and components this coolant is further collected into container and further directed into grinding machine for grinding purpose the tray angle with horizontal plane is inclined in such a way that it must be able to direct the components into the funnel

Galvanized steel is produced by coating the steel in zinc. The properties of galvanized steel are a unique combination that makes it ideal for use in interior and exterior applications

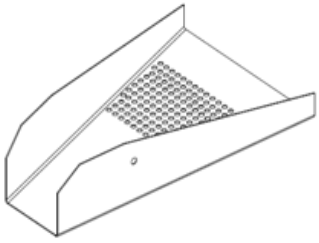


Fig. 3. Perforated tray

1) Angle of Repose

Angle of Repose is a minimum angle between inclined and horizontal surface at which the part begins to slide or rolled by overcoming friction between part surface and metal in which it's in contact with.

It is essential to find minimum angle at which part starts rolling. Hence angle of repose is found as following:

$$\tan\theta = \mu$$

The coefficient of friction between steel and steel can be varying from 0.09 to 0.2.

Hence, considering the value of coefficient of friction as 0.15.

$$\tan\theta = 0.15$$
$$\theta = 8.53 \text{ deg}$$

B. Design of Column

A column in architecture and structural engineering is a structural element that transmits, through compression, the weight of the structure above to other elements below present in structure. Simply, a column is a compression member. The term column applies especially to a round or rectangular support with a pedestal, which is made of material according to requirement/application or its aesthetics. A wooden or metal support is typically called a post, and supports with a rectangular or other section are usually called piers.

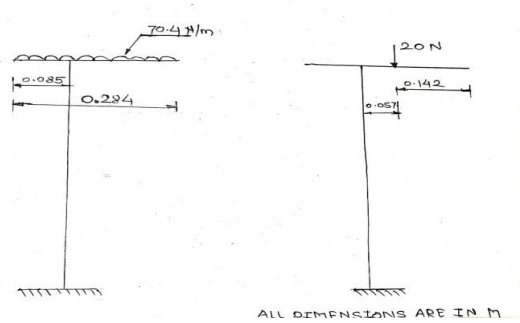


Fig. 4. Loading of column

1) Calculating allowable stress in the column

The column is subjected to direct force as well bending moment. So, it is essential to calculate forces acting on the column.

Total load acting on column = Load due to Components + Load due to Coolant

Load due to Components:

Assume 10 components are sliding on tray.

Mass of each component = 6gm

Total Mass = 6×10 = 60gm = 0.06Kg

Total Weight = 0.06 × 9.81 = 0.58N

Load due to coolant:

Area of Tray = 32518 mm^2

Volume of Tray = 2211224 × 10^9 m^3

Weight of Coolant = V × Density of coolant × Gravitational Acceleration

Weight of Coolant = 19.521 N

Total Stress = Direct Stress + Bending Stress

$\sigma = \sigma_d + \sigma_b$

$$\sigma = \frac{40}{30\times30} + \frac{20\times57\times15}{\frac{30^4}{12}}$$

σ = 1.00714Mpa

The allowable tensile strength of the material is 240 Mpa.

And the Induced stress is less than the allowable strength of the material. So, the column is safe against the induced stress.

4. Construction and Working

A. Principle

The Pneumatic energy is used to transfer the component from one location to another. The Pneumatic pressure itself gives the pushing effect to the next component.

B. Construction

Fig. 5. Parts transfer mechanism

- Perforated Tray

Tray is used to collect the parts from the grinding machine and the holes which are provided on that tray are used to remove the coolant which is collected in tray and avoid the further flow coolant on the system.

- Funnel

The vortex shape Funnel is used to direct the part towards the inlet of pressure line. The Funnel is so design that the incoming part is tilted in vertical direction. The inside diameter of Funnel

is kept slightly greater than that of parts which are to be transfer.

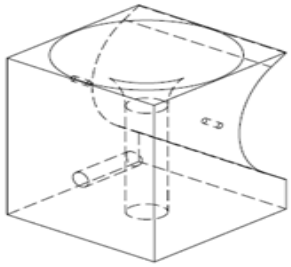


Fig. 6. Funnel

- Pressure Regulator

A pressure regulator is generally a control valve which reduces the input pressure of a fluid or a gas to a desired value of output.

- Pressure Line

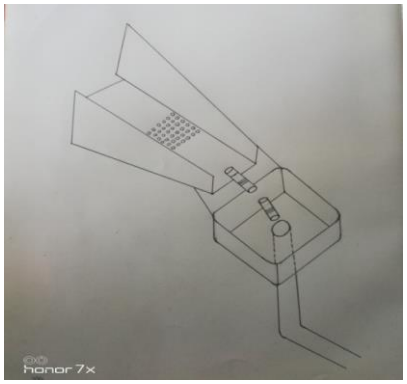
The pressure line is nothing but the part carrying tube. The inside diameter of the tube is slightly greater than outside diameter of the part which is to be transfer.

- Column/Stand:

Column is a crucial component which is used to transfer the weight from the assembly to the stand then to the ground.

C. Working

- Its desired to separate coolant and recycle it to grinding machine hence holes with diameter 3mm are made which completely separates coolant from part
- This parts are further directed into the pressure line through funnel
- This part is further moved with the help of regulated compressed air in such a way that it is able to cover 700mm distance
- This component is moved further with the help of regulated pressurized air which is regulated with the help of pressure gauge
- These components with diameter of 8mm and length of 36mm are stopped with the help of striking component which is present in front of it
- Due to the pressure force the component which is present in front of moving part is slightly moved forward and deburring operation is performed.



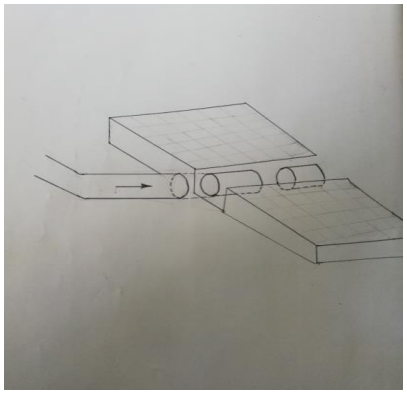


Fig. 7. Working

5. Specifications

S. No.	Components	Specifications
1.	Perforated Tray	Make: POSCO India Ltd. Material: GI Sheet Thickness: 0.8 mm
2.	Funnel	Material: PCS Size: 60x60x70mm (VMC Manufactured)
3.	Funnel Cover	Make: POSCO India Ltd. Material: GI Sheet Thickness: 0.8 mm
4.	Pressure Regulator	Make: Festo Model: 161128 Pr. Range: 0 to 16 bar
5	Pressure Line	Outer Diameter: 12mm Inner Diameter: 8mm
6.	Column	Material: Aluminum Alloy Make: Rose +Krieger Dimensions: 30x30mm

6. Future Scope

In this entire project we faced some difficulties which must be studied to increase preciseness of the model

- Parts can be directed by using double acting pneumatic cylinder which will help components to guide in perfect manner
- Coolant discharge can be controlled further by using baffles spaced in a proper manner
- Surface finish of the component can be further controlled by using cotton wick settled on deburring machine table.

7. Conclusion

- Cylindrical parts with small dimensions can be transferred by using polyurethane tubes by directing compressed air through it
- Coolant can be separated by using proper holes on tray
- Effort of a trainee to transfer those parts is hence neglected and due to this manpower is reduced which can be used in other place and also reliability of the operation is increased.

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