Development of Air Flow System PAGG Parts for PCD-450 Machine

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Abstract— Air flow system parts for PCD-450 machine. PCD (Plieuse Caisses Decoupees) is a French word meaning that Folding Die Cut Boxes Machine. This machine is used to fold the boxes. The air flow parts are vacuum pipe, inlet valve, exit valve. Vacuum pipe is used to fold the box. Air with high pressure passes through the vacuum pipe. Due to high pressure folding takes place with high speed. Inlet valve is useful for analysis. Material used for manufacturing of pipe and valve is Galvanized Steel. Designing of the pipe and valve are done on Catia Software, manufacturing process is die forming process.

Key words: Material Selection, CATIA Designs, ANSYS Analysis, Modern Manufacturing Process, Modern Tools, Quality Control, Time Study & Work Study, Testing Methods

I. INTRODUCTION

The term Use of boxes is increasing day by day. They are considered to be more convenient for folding boxes. Due to increasing demand, the quality and aesthetics of box folding machine should be maintained. To maintain the required quality two main things are required to look after, they are: box quality, thickness of box, speed of feeder. If the pressure is not proper it may lead to the rejection of the boxes. This proper pressure would not be achieved on fully automatic machine, as this machine includes both gluing and folding of boxes. The process is quick and less time for gluing and folding.

Fig. 1.1: Unassembled PCD 450 Machine

- The machine is an improved one which includes quality folding which makes quality production and meets the requirements of the customer and avoids box rejection.
- The design and manufacturing of this machine is a simple one which does not involve any special training by the operator.
- Use of boxes are increasing day by day. They are considered to be more convenient for foldig boxes.
- Due to increasing demand, the quality and aesthetics of folding should be maintained. The need of machine continue to increase, and the complexity of operation organization increases.
- The factors affecting the operation safety and reliability become more, fault rate continues increasing. Therefore, how to improve the reliability of rail transit hardware equipment, passenger service, reduce the occurrence of fault is very important.
- The process is quick and less time for folding the box is achieved. Hence, evolving to the need of folding and gluing machine which maintains the quality of folding the boxes and plays a vital role in maintaining gluing.
- The PCD 450 Machine is very essential for folding boxes and play vital role in development of gluing technology. The pressure of air on boxes must be appropriate to overcome the misalignment of boxes otherwise this boxes rejected. Fast rejection due to Working Speed of the PCD 450 machine.

Productivity improvement is to do the right things better and make it a part of continuous process. Therefore it is important to adopt efficient productivity improvement technique so as to ensures individuals and organisation's growth in productivity .The aim of this chapter is to introduce and understand productivity improvement various technique of productivity improvement, work study and its relation with productivity improvement.

In a production department of an industry there is unnecessary processes are conducted often the same work can be done using more simple and less complicated tools. This is something that costs money and in some cases time. Planning these processes will ensure company to avoid overwork when more simple work could perform the task. Because a very wide range of sizes and weights are used at studied company it is important to consider what type of transportation equipment to use for each material type. It is necessary to avoid using equipment that is more complicated, heavier and takes more time to use.

Countershafts are short shafts between the driver motor and the driven machine. Head shafts or stub shafts are shafts directly connected to the motor. Motion or power can be transmitted through an angle without gear trains, chains, or belts by using flexible shafting. Such shafting is fabricated by building up on a single central wire one or more superimposed layers of coiled wire.

Regardless of design requirements, care must be taken to reduce the stress concentration in notches, keyways, etc. Proper consideration of notch sensitivity can improve the strength more significantly than material consideration. Equally important to the design is the proper consideration of factors known to influence the fatigue strength of the shaft, such as surface condition, size, temperature, residual stress, and corrosive environment. High-speed shafts require not only higher shaft stiffness but also stiff bearing supports, machine housings, etc. High-speed shafts must be carefully checked for static and dynamic unbalance and for first-and second order critical speeds. The design of shafts in some cases, such as those for turbopumps, is dictated by shaft dynamics rather than by fatigue strength considerations. The lengths of journals, clutches, pulleys, and hubs should be viewed critically because they very strongly influence the

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overall assembly length. Pulleys, gear couplings, etc., should be placed as close as possible to the bearing supports in order to reduce the bending stresses. The dimensions of shafts designed for fatigue or static strength are selected relative to the working stress of the shaft material, the torque, the bending loads to be sustained, and any stress concentrations or other factors influencing fatigue strength. Shafts designed for rigidity have one or more dimensions exceeding those determined by strength criteria in order to meet deflection requirements on axial twist, lateral deflection, or some

II. METHODOLOGY

- Define the Problem statement
- Idea generation
- Identify customer needs
- Do the market survey
- Define objectives of new product
- New product development life cycle
- Study of PCD-450 Machine and PAGG parts
- Calculate the reed rate and at that feed rate pressure
- Drawing the various parts of air flow system and dust collector
- Design the various parts of air flow system and dust collector on CATIA
- Analyse the various parts of air flow system and dust collector on ANSYS
- Finally Analyse PAGG assembly and Dust Collector Assembly on ANSYS
- Predict the result of feed rate 2400 boxes per hour and pressure required
- Manufactured various Parts
- Testing done

Fig. 2:

III. CONCEPT DESIGN

- Creative Ideas.
- Refined concept
- Retrieve past design intent
- Check market conditions
- Define set of specifications
- Produce drawing

IV. MATERIAL SELECTION

Properties of Galvanised Iron:

Properties	Amounts
Poisson Ratio	.36
Modulus Of Elasticity	300GPa
Hardness Number	100BHN
Electrode Potential	-.00400V
Ionic Radius	0.640A
X-ray absorption edge	1.743A^0
Thermal Conductivity	80.2Wper mk
Carbon, C	0.4
Sulfur, S	.25
Manganese, Mn	0.65
Lead Pb	.02

Table 1:

V. CALCULATIONS

Problem=A 200mm diameter pipe used for air flow system having 2880mm length convey air from compressor and velocity of air is 3 m/sec. So calculations of losses, discharge, pressure loss

Calculations for Air Flow System:

H-Total Head Loss

Density of air(r) – 1.225 kg/m^3

Acceleration due to gravity(g)- 9.81 m/s^2

Diameter of Pipe(D)-200mm

length of pipe(L)-2880mm

Velocity(V)-3m/sec

friction factor(f)-0.03

Area= 4.13/4*(D)^2=0.0314159 m^2

Calculation for Head losses –

H= [Head loss due to friction] +[Head loss due to entrance]+[Head loss due to exit]

H= fLV^2/(2gD)+0.5V^2/2+V^2/2

=0.03*2.880*9/(2*9.81*0.2)+0.5*9/2+9/2

H =8.73165 m

Discharge of air(Q)-

Q=Area * Velocity

Q=AV=0.0314159*3=0.09425 m^3/sec

Pressure Loss(P)-

P= density of air *acceleration due to gravity*head loss

P= 1.225*9.81*8.73165

P=104.93 N/m^2

P=0.0010493 bar

So because of very small Pressure loss in Air flow system we selected 200mm diameter pipe and Length of component as per PCD-450 Machine

VI. CAD DESIGN

CATIA is the world's engineering and design leading software for product 3D CAD design excellence. It is used to design, simulate, analyze, and manufacture products in a variety of industries including aerospace, automotive, consumer goods, and industrial machinery, If you stop and take a look around, CATIA is everywhere. CATIA is in the plane that just flew over, the car that just went silently by, the phone you just answered, and the bottle of water that you just finished.

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A. Air Flow System

1) Air Duct

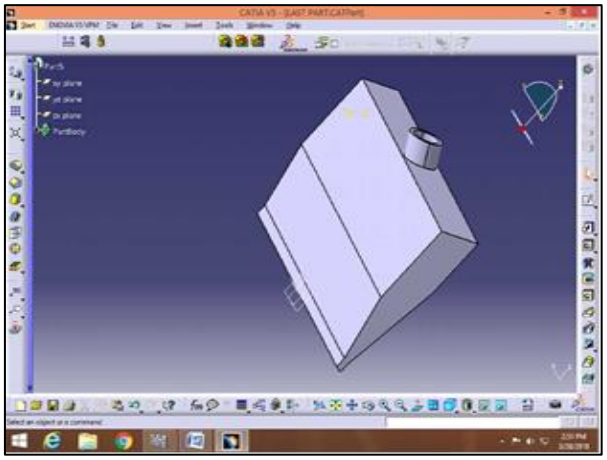

Fig. 3:

2) Connector Pipe

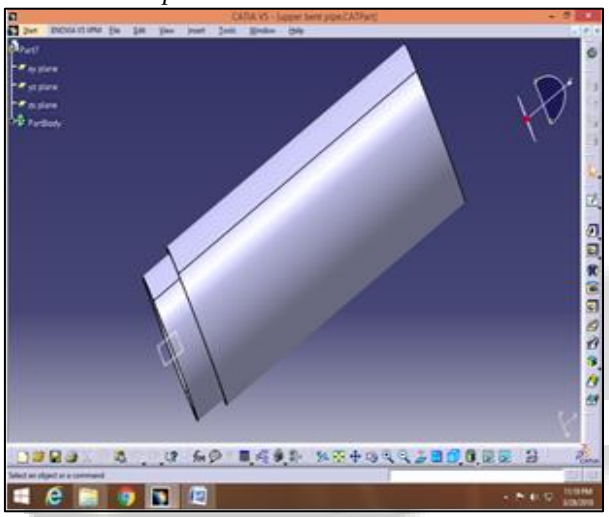

Fig. 4:

3) Bent Pipe

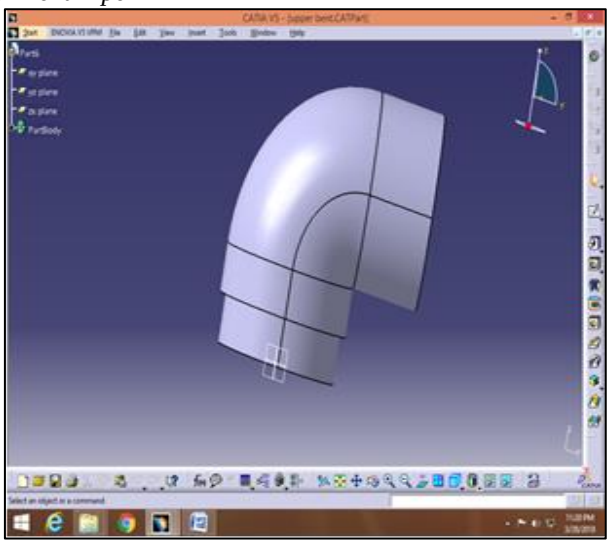

Fig. 5:

4) Air Duct Venturi

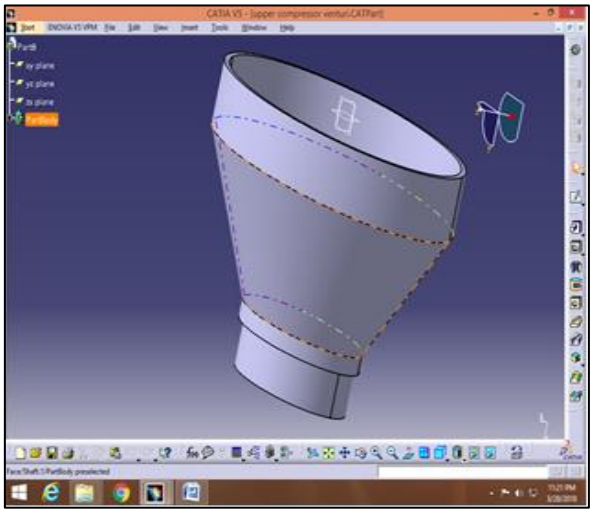

Fig. 6:

5) Final Assembly of PAGG

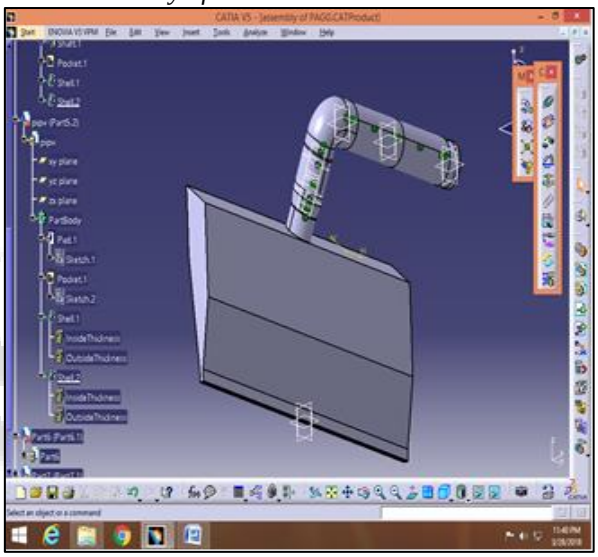

Fig. 7:

B. Dust Collector System

1) Dust Absorber Bent Pipe

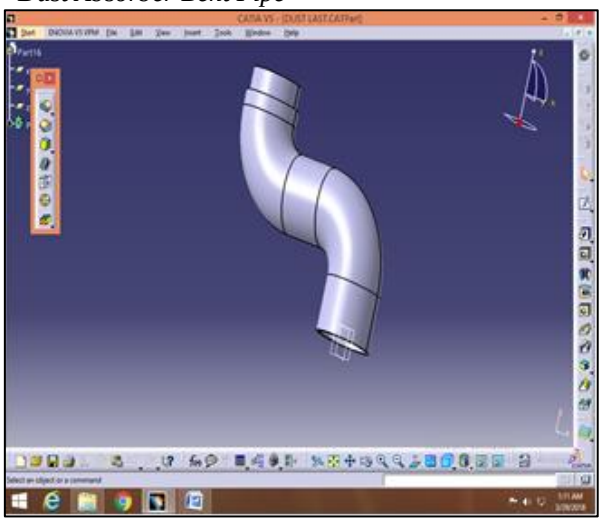

Fig. 8:

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2) Acier Junction Pipe

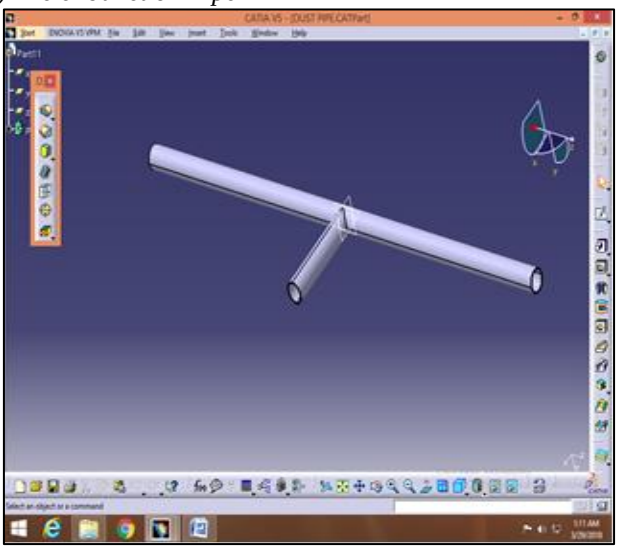

Fig. 9:

3) Bent Pipe

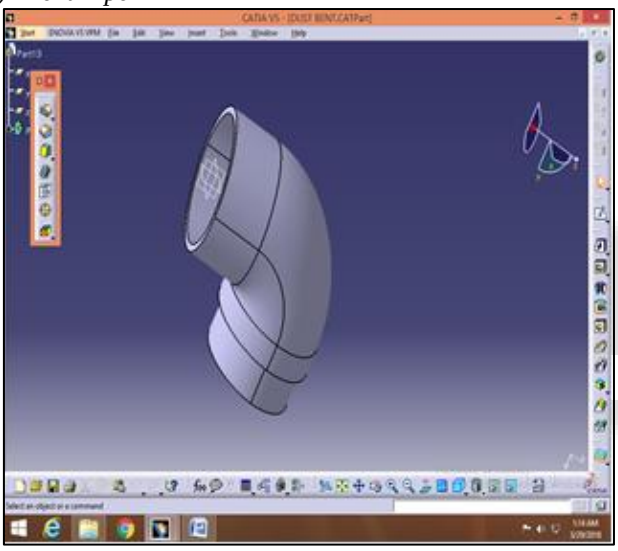

Fig. 10:

4) Connector Pipe

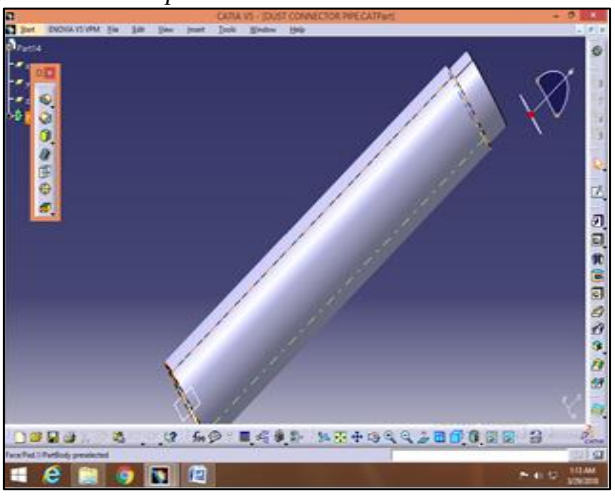

Fig. 11:

5) Dust Collector Pipe

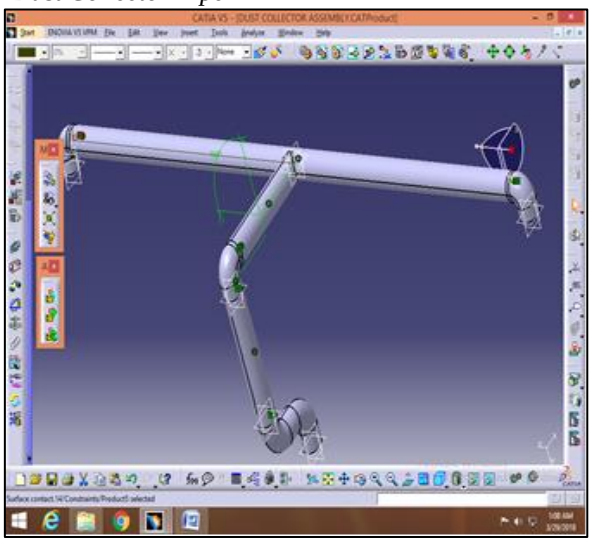

Fig. 12:

VII. SET UP PRODUCTION

- Procure Manufacturing capabilities
- Design the tooling operations
- Build the tool
- Modify building
- Obtain equipment
- Start up the production
- Get newly formed parts
- Test parts
- Verify quality tollerances

VIII. MANUFACTURING

A. Casting

1) Pattern Making
2) Core Making
3) Mould Making
4) Gateing System
5) Runner
6) Riser

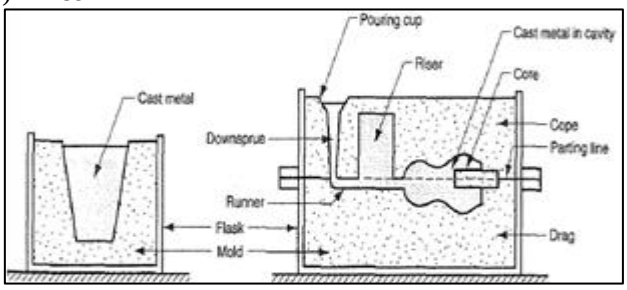

Fig. 13:

B. Welding Process

TIG (Tungsten Inert Gas Welding Process)

1) Welding Machine AC / DC.
2) Protected gas tube.
3) Protected gas regulator.
4) Flow meter for gas.
5) Gas hose and fittings binder serve.
6) Electrode cable and hose serves.
7) Welding torch serves.

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8) Tungsten electrode serves.
9) Welding wire serves.
10) Accessories selection

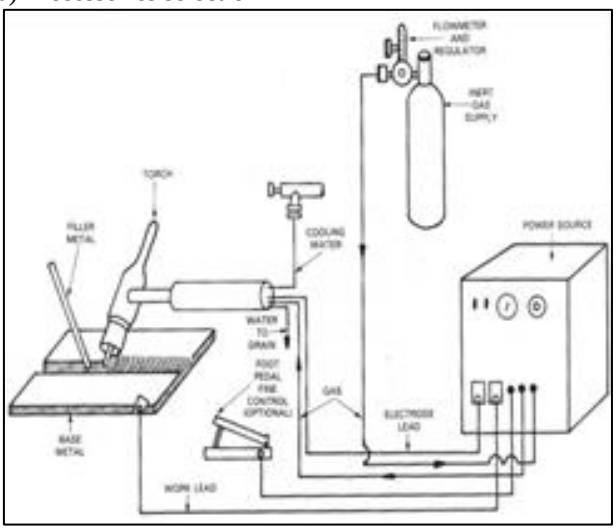

Fig. 14:

IX. ADVANTAGES

- Safety
- Low losses
- High vacuum creation
- Oxidation resistance
- Smooth working
- Improved life cycle

X. IMPLEMENTATION

Implementation of this air flow system with air dust collector in PCD-450 machine by using various equipment. This system is implemented with air compressor for high pressure. Now system is working in company. Pressure of air controlled by pressure gauge and air velocity depends upon pressure. By this developed system losses of air reduced and we get accurate pressure for feeding boxes.

XI. EXPERIMENT RESULTS

The result of operation of system is highly effective. Due to this system the feeding rate of boxes increase to 4500 boxes/minute from 1200 boxes/minute. The material used for manufacturing is easily available. So due to this design of system pressure losses reduced and machine work efficiently.

XII. CONCLUSION

Electrically operated PCD 450 machines with various air flow system are available in market, but economically they are expensive. With an aim to reduce cost and use source of energy that is available in plenty (air),"Development of Air Flow System Parts for PCD 450 Machine" is introduced. Cost reduction and less energy consumption are the main factors achieved by this system. They are user-friendly and less harmful to humans as compared to hydraulically and electrically operated PCD 450 machines.

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