International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Blade Tucking Machine

J. M. Kavin Raj[1], J. Jayahari[2], S. Ram Kumar[3], A. Mohamed Ismail[4]
[1,2,3]*B.E. Student, Department of Mechatronics, Bannari Amman Institute of Technology, Erode, Tamilnadu*
[4]*Assistant Professor, Department of Mechatronics, Bannari Amman Institute of Technology, Erode, Tamilnadu*

***Abstract*: This paper presents implementation of blade tucking machine.**

***Keywords*: blade tucking machine**

1. Introduction

Blade dispensing is the first station of the Blade Tucking Machine. This blade dispenser is used to separate the blades one by one from the stacked blades which are loaded in the chute. This blades are dispensed into the bucket which are transferred to the next station Tuck Pick & Place.

Tuck Pick & Place is the second station of the BTM. In this station, the tucks are stacked in the chute manually. The epi-cyclic gears with suction cups are used to pick, open and place it on the tuck conveyor. The front top and bottom flab is opened by 90° and the back bottom is closed.

In second station we have 4 conveyors. The first conveyor is Pusher Cam mechanism, second is bucket conveyor, third is intermediate transferring unit and fourth is tuck conveyor. The blades are pushed to tuck through the intermediate transfer unit by the Pusher Cam mechanism.

The back top flap will be at 180°. The laser marking will be done in this flap. The laser marking is done by etching the top flap. The camera is placed next to the laser marking which verifies whether the laser marking is done correctly.

The HEKAL-SUPRA120 glue is used to paste the flaps of the tuck. The glue is heated to 145° and sprayed using the glue gun on either sides of the tuck. SUPRA120 glue is used because it drives within few micro seconds. Once the gluing is over the top flaps of the tuck is closed using a slide guide.

After the tuck is closed, now the rejection will take place. Generally, 3 tucks will be rejected during the start of the machine. The 3 tucks are as; one before the gluing gun, tuck on the gluing gun and the tuck after the glue gun. After this 3 rejection, a fibre optic sensor is used to detect the effects in the packed tuck. The value actuation is based on the speed vs timing.

Speed of the motor and conveyor are detected by encoders and the timing is given manually by HMI (Human Machine Interface). Based on the distance between the sensor and the rejection unit the timing is manually set. After rejection, an in-feed conveyor is used to push the packed blades at a faster speed. During this time the glue will be pasted evenly. A top guide is placed above the conveyor to avoid the collision of the tucks. The packed tucks from the in-feed conveyor is then passed inside the weighing machine.

It has 3 conveyors; first and third conveyor is used to change the speed of the conveyor. A 150mm second conveyor is used to weigh the tuck. Based on the weights, we have two rejections; one is for overweight and another is for underweight. Remaining accepted will be passed to output feed conveyor. The output feed conveyor pushes the tuck to 90° flip. Now the tuck will be rotated to 90° for easy unloading.

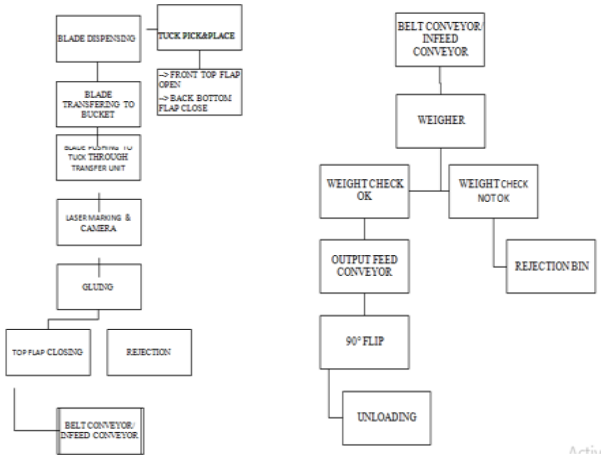


Fig. 1. Flow chart

2. Old blade dispenser

The process flow chart is as follows,

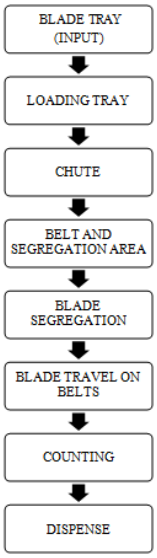


Fig. 2. Flowchart

A. Blade tray

The wrapped blades which should be packed using this machine are initially stacked in a tray as storage. These blade trays are stacked in racks which will be used as input for this blade tucking machine.

B. Loading tray

The blade trays are loaded above the chute in a loading tray.

C. Chute

This is similar to the working principal of hopper. It is used to stack the wrapped blades. These stacked blades are faded to the blade dispenser machine.

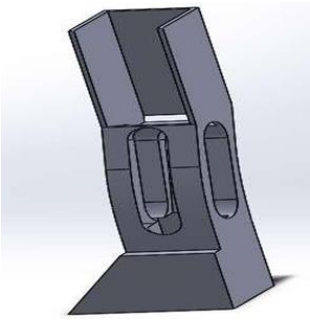


Fig. 3. Chute

D. Belt and segregation area

The blade is stacked in the dispenser stacker. The walls were vertical in the earlier design. Due to Heavy load applied on the bottom blades, there was a possibility of two or more blades coming out of the dispenser stacker. Because of this reason the walls of the dispenser stacker are tapered. The bottom most blade will be very closer to the tip of the dispenser stacker than the second blade. The gap between the dispenser stacker tip and the belt conveyor is 150 micron. A back support is given to the back wall of the dispenser stacker for more inclination purpose.

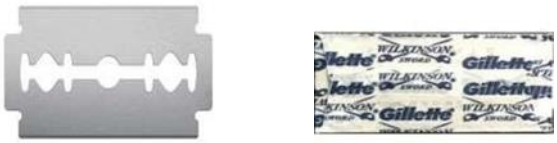


Fig. 4. Blade

Thickness = 0.09mm	Thickness=0.24mm
Breadth = 21.87mm	Breadth=24.44mm
Length = 42.82mm	Length = 44.68mm

E. Blade segregation

As the gap between the dispenser stacker tip and the conveyor belt is 150 micron. The thickness of the wrapped blade is 240microns. The thickness of the blade is 90 microns. As the wrapper is compressible in nature, it is compressed and passed through the 150 Micron gap. This helps in sending one blade at a time.

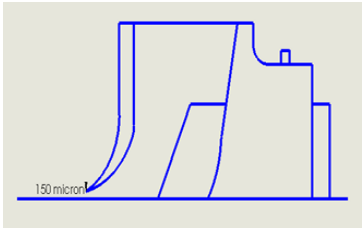


Fig. 3. Blade segregation

F. Blade travel on belts

The blades which come from the tip of the dispenser stacker passes in a belt conveyor. It is shifted to the end belt conveyor.

G. Counting

A sensor is used for counting which is placed in between the driven pulley and idler pulley. It senses according to the distance between the two blades. The average distance between the two blades are 8mm.

H. Dispense

After the counting process, the blades are dispensed to the bucket.

I. Working of blade dispenser

In Old blade dispenser, the blades are stacked in between the vertical magazine. So, in this type of blade dispenser, the blades are stacked one by one. So, the bottom most blade holds the full load of all the blades in the chute. This increases the load and friction on the blades. So, the blades will be stuck at the blade segregator. In old magazine, all the blades are stacked in horizontal position in vertical magazine. So, the whole load will be acting at the bottom most blade, when the belt conveyors rotate at high speed. It will get stuck at the blade segregator. To overcome from this problem, the shape of the magazine is changed due to this type of magazine. We get some micron level space between the blades. This helps to dispense the blades one by one.

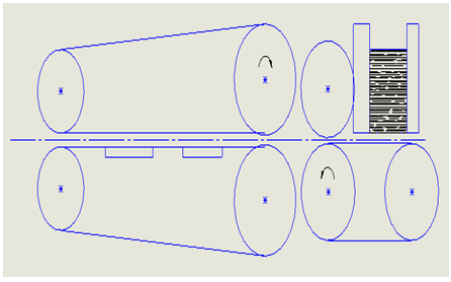


Fig. 5. Working of blade dispenser

The driver pulley is mounted on the shaft of the servo motor. The driver pulley and driven pulley is connected with the toothed grove belt. The driver pulley is smaller than the driven pulley in order to increase the torque. The torque is increased to withstand the heavy load of the stacked blades. The driven shaft is connected with another toothed belt drive. This toothed belt drive is connected with the flat belt drive which is used to

segregate the blades. The driver shaft of the second toothed belt drive is connected with the conveyor of the dispenser stacker. The driven shaft of the second toothed belt drive is connected with the end conveyor. The pulleys of the end conveyors are smaller when compared to that of the other belt drives. This is used to change the speed between two flat belt conveyors. The speed variation leads to increase the distance between the two blades in the end conveyor. This gap formed is used by the counting sensor. After the counting process, the blades are dispensed to the bucket for next process.

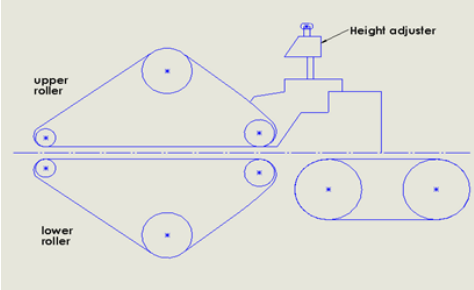


Fig. 6. Roller

Conclusion:

As the blade wrapper is approximately 1mm larger than the blade size. So the end of the two wrappers may enter the gap at a time and might get struck or tear out.

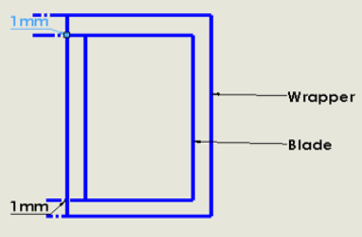


Fig. 7. Wrapper

When the two blades are attached together, then the thickness of the blade will be approximately 480microns. As the designed gap is 150 micron, these two blades will get stuck or it might tear the wrapper. In order to overcome this problem, a new Blade Dispenser with Gearboxes are used.

J. *New blade dispensor*

The flowchart of the new blade dispenser is as follows,

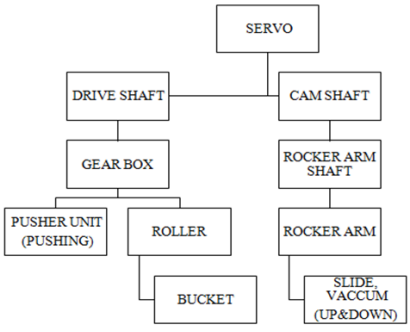


Fig. 8. Flowchart

K. *Description*

1) *Servo motor*

The servo motor powers the drive shaft and the Cam shaft.

2) *Drive shaft*

Each Gearbox is mated with the gears which are mounted in the drive shaft. This transfers the power from the servo motor to the gearbox.

3) *Gear box*

The gear A with 45 teeth is mounted on the drive shaft. Gear A is mated with gear B (45 teeth). Gear C is mated with gear B, which is connected with the crank on the slider of the Pusher unit. Then, gear C is mated with gear D (32teeth), which increases the speed of the gear. This gear D powers the E and F gears (15teeth) which is connected with the rollers. This rollers are used to dispense the blades.

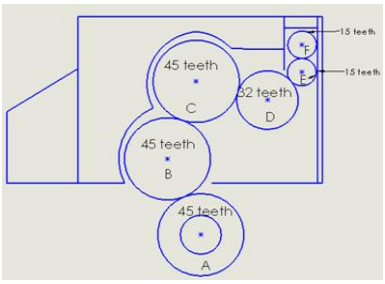


Fig. 9. Gear box

4) *Pusher unit*

Cam is mounted on the main shaft and the Cam follower is linked with the Rocker arm shaft. A Rocker arm is connected to the suction cup base. The Rocker arm transfers the rotary motion into linear motion. This linear motion is used to push the suction cup up and down. This suction cup is used to suck a blade from the chute. Pivot mount is fixed to the push floor and supports the rocker arm and makes the slider to move up and down. The crank in the gearbox is mounted with Push slider which moves in front and back motion. This motion pushes the blades into the bucket.

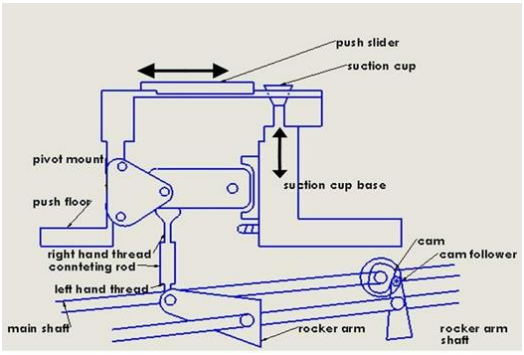


Fig. 10. Pusher Unit

5) *Roller and bucket*

The roller is connected with the shafts of E and F gears. The gap between the two rollers is 125 micron. This roller pushes the blade to the bucket.

6) Cam shaft

Cam shaft is powered by the servo motor. A cam is mounted on this shaft which has a cam follower. Based on the profile, an arm connected with the cam-follower converts the rotary motion to linear motion.

7) Rocker arm & rocker arm shaft

The Rocker arm is mounted on the Rocker arm shaft, which is connected with the pivot mount using a connecting rod.

8) Working of new blade dispensor

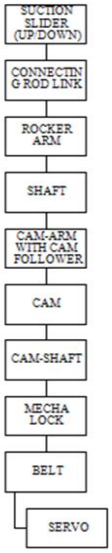
The servo motor powers the drive shaft and the cam shaft using toothed belt. The drive shaft has 7 gears, which are mated with 7 gearboxes. Each gearbox has 2 rollers in each side (LHS & RHS). These rollers are used to dispense the blades into the bucket. Each gearbox has 1 crank at both the sides (LHS & RHS). This crank is used to convert the rotary motion into linear motion. This linear motion is used to slide the Push slider. The push slider pushes the blade into the bucket through the rollers. The Cam follower connected to the Rocker arm shaft pushes the vacuum cup up and down with the help of a slider connected to the connecting rod. As the suction cup sucks the blade, the push slider pushes the blade to the bucket through the rollers attached with the gearbox.

Conclusion:

Timing – Slide Pusher(forward/reverse) vs Slide Suction (up/down)

If the Pusher is in forward motion, then the suction cup slider will be in downward position and vice versa.

PUSHER	FRONT	BACK
SLIDER	DOWN	UP
ROCKER ARM & CONNECTING ROD	UP	DOWN
SUCTION CUP	OFF	ON



Power-Motion Connections:

1) Pusher Slider:

Gearbox→Crank→Forward & Reverse motion

2) Suction Cup Slider:

Rocker arm→Connecting rod→Link→Slider up & down

3) Roller:

Gearbox→Rotary motion

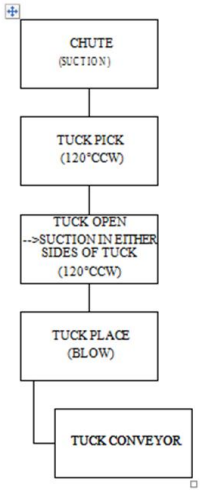
4) Gearbox:

Servomotor→Belt-drive→Shaft-with gears→GearboxRotary motion.

5) Rocker Arm:

Servomotor→Belt drive→Cam Shaft (Rotary) →Cam follower→Cam follower arm→Main shaft→Rocker arm→Up & Down Linear motion.Hence, this mechanism helps to overcome the failure occurred in the Previous Blade Dispenser.

Tuck Pick & Place:



L. Components and Description

1) Chute:

It is used to load the tuck manually which will be feed to the suction cup one by one.

2) Epicyclic gear

An epicyclic gear is powered using servo motor (CCW). It does not have a sun gear instead; it has a driven pulley mounted on the servo motor. A disc is attached with the driven pulley using a shaft. Three planet gears are mated with the internal teethed gear. Each suction cup holding discs are attached with each individual planet gears. Three housings are attached on the disc with driven pulley. A stationary gear is fixed on the housing. This stationary gear powers the two driven gears as in the figure. The final driven gear is used to rotate the suction cup.

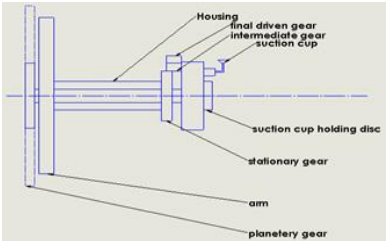


Fig. 11. Epicyclic gear

As per the requirement, the suction cup has to rotate in Counter- Clockwise. So, the servo motor rotates in Counter-Clockwise. The planetary gears rotates in Clockwise. The bigger disc rotates in Counter- Clockwise. The smaller discs rotate in Clockwise. As per the below diagram, we obtain the final driven gear rotating direction to be Counter- Clockwise.

3) Suction Cup

Each smaller discs has a suction cup. Each suction cup creates a suction pressure of 2-3 bar approximately. This suction pressure is used to hold the tuck.

Additional suction cup is placed opposite to the chute, which is used to open the tuck. This suction cup has a lower suction pressure of 1.5 bar approximately.

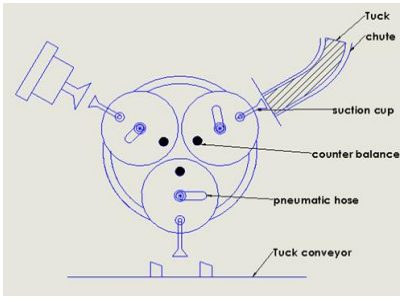


Fig. 12. Suction cup

M. Working of Tuck Pick & Place

In earlier stages, the trace of tuck pick and place was developed as shown in figure. It had a larger curves and radius at the three positions. Due to these larger curves, the tuck picking was not exactly at same place. This made the tucks not to place properly in the suction cup. Because of this, the tuck opening and placing was not proper.

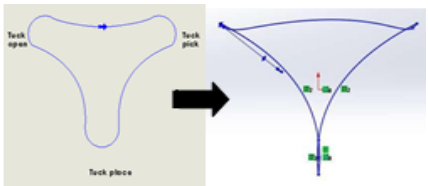


Fig. 13. Working of Tuck Pick & Place

In order to overcome this problem, a new trace of the tuck pick and place was developed by changing the position of gears. The new trace is as follows; by using this new trace, the tucks are picked at the same position exactly. The three suction cups are placed at an angle of 120° between each other. The angle measurement of each suction cup is considered as below. The first suction cup sucks the tuck from chute at position1. Then, this suction cup rotates to 2nd position, where another suction cup opens the tuck. Now, this suction cup rotates to 3rd position. Here, the vacuum is cut- off just before the 360° and the tuck is placed exactly on the tuck conveyor by blowing air through the Same suction cup. The air valve and vacuum valve are opened and closed based on the timing and the calculations as below.

The calculation below is for 300PPM;
Let's assume the PPM of the machine is 300PPM,
For each on rotation of 360°, we obtain 3 parts.
360° = 1 rotation = 3 parts
Then, for

Degree	Activity	Position of work
360°/0°	Placing	• Vacuum OFF • Air purge ON (timing) • Vacuum OFF • Air OFF

X rotation = 300 Parts
As, 1 rotation = 3 Parts
Hence,
100 rotation = 300 parts for 1 minute
Then, Time taken to rotate 1° will be;
As,1 minute = 60 seconds
1 minute = 100 rotation
Then, 60/100 = 1 rotation
Hence, 1 rotation = 0.6 seconds = 600 milliseconds
360° = 600 milliseconds
1° = 600/360 = 1.66 millisecond
Hence, 1° = 1.66 milliseconds

	Tuck 1 Ejection ON position	Tuck 1 Vacuum ON position	Tuck 2 Ejection ON position	Tuck 2 Vacuum ON position	Tuck 3 Ejection ON position	Tuck 3 Vacuum ON position	Ejection ON time	Tuck placing Pressure	Tuck opening Pressure
60 ppm	355	50	115	170	235	290	40	2.0	1.0
120 ppm	356	50	116	170	236	290	40	2.0	1.0
180 ppm	350	50	110	170	230	290	40	2.0	1.0
210 ppm	345	50	105	170	225	290	40	3.0	1.0
240 ppm	344	50	104	170	224	290	60	3.0	1.0
270 ppm	342	50	100	170	222	290	60	3.0	1.5
300 ppm	340	50	100	170	220	290	60	3.0	1.5
330 ppm	338	50	98	170	218	290	60	3.0	2.2

N. Working of Placing

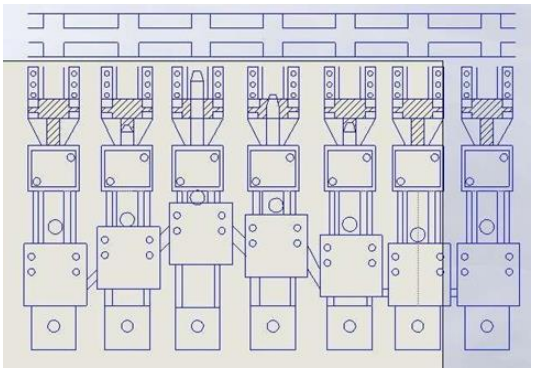


Fig. 14. Working of Placing

O. *Working of suction cup*

The direction control valves used in vacuum valve and air valve is 3/2 solenoid with spring return. The vacuum valve is a Normally Open valve and the air valve is a Normally Closed valve. The NO and NC diagrams are as follows;

Based on the timing and angle given, the vacuum and air (ON/OFF) will shift automatically by using DCV. Hence, by this process, the tuck is placed on the tuck conveyor.

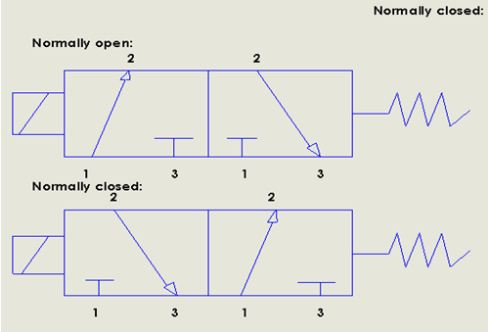


Fig. 15. Working of suction cup

P. *Transferring unit*

→Bucket conveyor
→Pusher Cam mechanism
→Transfer conveyor
→Tuck conveyor

The servo motor powers the shaft using the toothed belt drive. This driving shaft has five sprockets connected for various chain drives.

Q. *Bucket conveyor*

A bucket is placed between two chain drives L-clamps are used to fix the top and bottom of the bucket with the two chain drives. The fixture of L- clamp is as follows; This bucket conveyor is placed just below the blade dispensing unit. So, from each roller in the blade dispensing unit will dispense blade into the bucket. Based on the number of chutes loaded, the same number of blades will be dispensed. This conveyor has 152 buckets approximately. This conveyor starts in blade dispensing unit and ends in the Tuck Pick and Place unit.

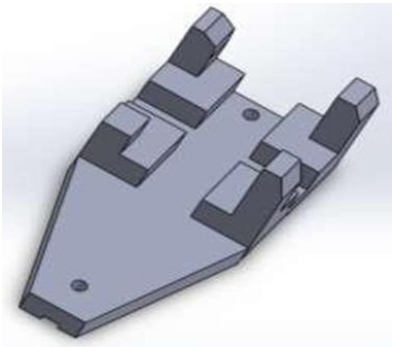


Fig. 16. Bucket conveyor

R. *Pusher cam mechanism*

A Pusher Cam unit is placed between two chain drives. L-clamps are used to fix the top and bottom of the pusher cam unit with the two chain drives. The ends of the pusher are fixed using L-clamps between the two fixed rods. The Pusher is placed above the rods. This is used to push the slider rod front and back based on the cam follower. One end of the slider rod has a block at the bottom with a cam-follower. This follower follows the Cam which pushes the rod front and back. The Pusher Cam conveyor has 36 Pusher. The slider rod has a spring connected to the bottom back which reduces the sudden impact and damages.

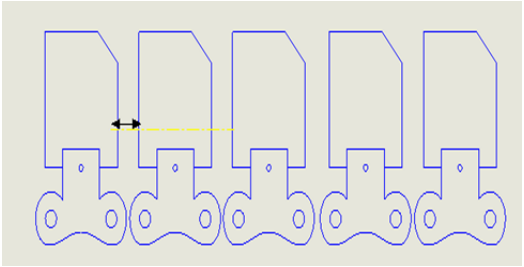


Fig. 17. Pusher cam mechanism

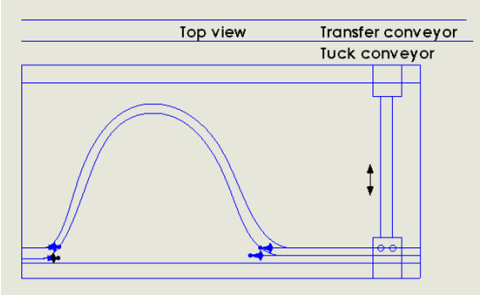


Fig. 18. Top view

S. *Transfer conveyor*

Transfer conveyor is placed next to the bucket conveyor. It has 26 intermediate transfer units. It helps the slider rod to push the blades from the bucket into the tuck. This intermediate transfer unit are placed on a single chain drive by fixing it with a L-clamp on either sides.

T. *Tuck conveyor*

Another pulley from the servo motor powers the tuck conveyor. This tuck conveyor starts from the tuck placing position of the tuck Pick and Place unit. The tucks are placed between the two fingers of the tuck conveyor. The bottom back flaps are opened 90° by a guide. This change in position of the flaps help the slider rod to push the blades easily into the tuck without flaws.

U. *Blade transfer unit*

For packing 10 blades in the tuck, we load 12 chutes and for packing 5 blades in the tuck, we load 7 chutes. The illustration is as follows;

	Chute14	Chute13	Chute5	Chute4	Chute3	Chute2	Chute1
Condition1	0	0	1	1	1	1	1
Condition2	0	1	1	0	1	1	1
Condition3	1	0	1	0	1	1	1
Condition4	1	1	0	1	0	1	1
Condition5	0	0	1	0	1	1	1
Condition6	0	0	0	1	0	1	0
Condition7	0	0	1	0	1	0	1

Condition 1, 2, 3 and 4 are OK conditions and Conditions 5, 6 and 7 are NOK condition.

If all the five blades have been dispensed properly, then it is an OK condition and it does not require the spare chutes. If any 1 or 2 chute did not dispense the blade, then the signal will be sent to the spare chute by the proximity sensor. So, the spare chute will dispense the blade accordingly.

If 2 or more chute did not dispense the blades, then it is Not OK condition. If both normal and spare chutes did not dispense blades, then it is Not Ok condition.

V. Tuck flaps

The tuck has two flaps at both the ends which is used to close after the blades are tucked.

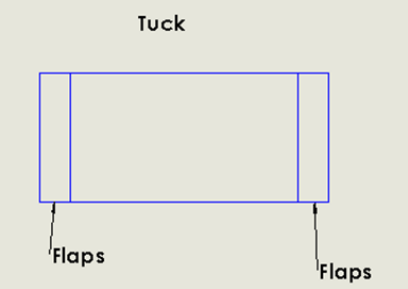


Fig. 19. Tuck flaps

Condition 1:

Front flap – Top and Bottom should be open

The front flaps of the tuck are pushed using the guides to 90°. This is done in order to tuck the blades easily. The front top flap will travel on the inclined guide. During this time, the flap will be gradually pushed to 90°. At the same time another guide at the bottom front flap will be travelled in between the guide and the chain conveyor.

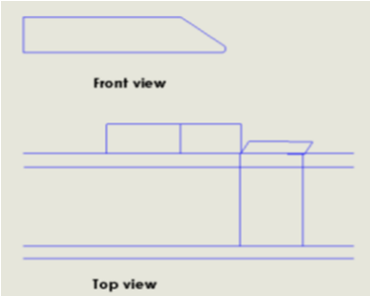


Fig. 20. Front and top view

Condition 2:

Backside bottom flap – Should be closed

The backside bottom flap is closed. The bottom flap is closed by the side guides. When the tuck passes through this guide, the flap will be closed gradually. The backside flap is closed. So that the blades to be tucked will not come out of the tuck.

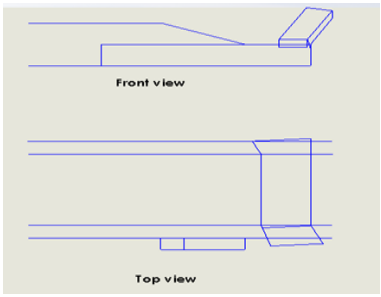


Fig. 21. Front and top view

Condition 3:

Backside top flap – should be in original position (180°). The backside top flap is placed in original position. So that the laser mark can be done on the flap.

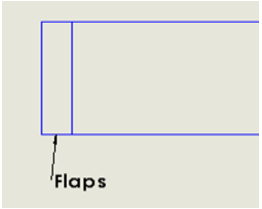


Fig. 22. Flaps

W. Laser Marking

Laser Marking is used to mark Batch number, Date of packing etc. These laser marking are used to identify the defected piece in later period. In laser marking we use Fiber Optic sensor. This sensor will sense the tuck and passes the laser beam on the tuck.

Laser marking is done by Etching process. It is a type of material removal process. In Etching process, material is removed by either chemical process or by giving electric pulse. Here, Etching is done by heat produced by the laser. Etching process are generally done to remove materials in micron level.

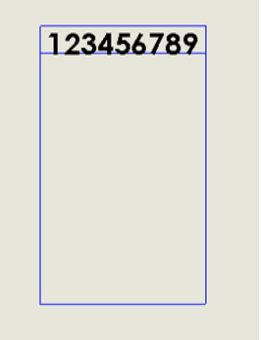
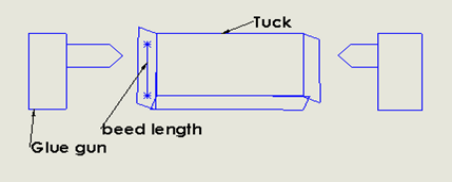


Fig. 23. Laser marking

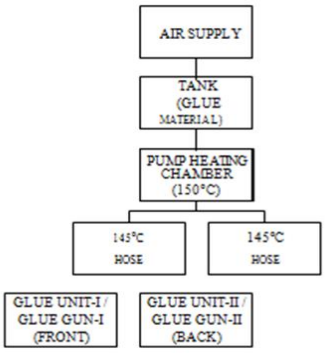
Next to the laser arking, a camera is placed. This camera is used to capture the laser marking and then it is used to check laser marking.

Gluing:

Gluing is the process of pasting the flaps of the tuck after tucking the blades. The glue used to paste the flaps is HEKAL-SUPRA 120. It is heated for about 145°C before pasting.



Glue is stored in the storage tank. Air is supplied into the storage tank. Now, the heating chamber heats the glue at 150°C. After heating the glue, the melted glue is passed in hoses with heating coil. Then the hoses are connected to the glue unit or glue gun. The glue gun is used to spray the glue on the front and back bottom flaps. A fiber optic sensor is used to sense the tuck and glues with respect to speed and time. Once the Laser marking is done, the blades are pushed inside the tuck by a guide and also the front bottom flap is closed using a side guide. Once the front bottom flap is closed using the guide, Glue is sprayed on both the bottom flaps. Once the glue is sprayed, the guide block holds the bottom flap and the same block is used to hold the top flange at 90°. At that time another guide is used to close the top flap.



Rejection:

Components to be rejected are as follows; While starting the machine, 3 components are as follows;

a. On the glue
b. Before the glue
c. After the glue

If the camera identifies more than 2 NOK conditions, the machine will stop immediately. It will reject at most 2 successive flaw tucks.

Working:

Elements used are;

1) 2/2 valve
2) Nozzle
3) 5/2 valve
4) DGSL-cylinder: Mini slide
5) Sensor

2/2 valve: This is connected with the air purge to push out the defected tucks.

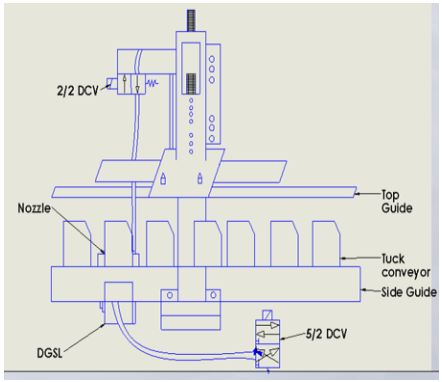
Nozzle: When 2/2 valve is actuated, the air is blew through the nozzle.

5/2 valve: This is connected adjacent to the conveyor for dropping the side guide as it makes a path for rejection piece DGSL-cylinder-mini slide: This cylinder is used to push the side guides up and down.

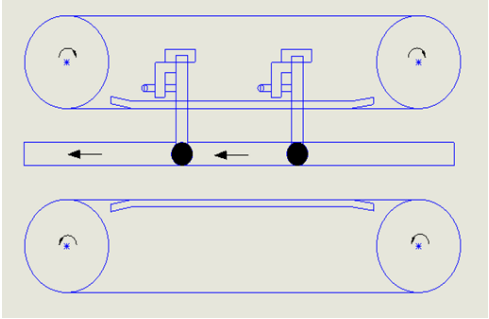
Sensor:

A fiber optic sensor is used to scan the objects which senses the defected tucks and sends for rejection. A fiber optic sensor detects the defected tucks and sends the signal to the HMI and then it is sent to the valves. Based on the signal, the valve actuation will be processed. When 2/2 valve is actuated, it will blow air through nozzle. When 5/2 valve is actuated, the side guide is dropped down. The side guide is dropped down with the help of DGSL cylinder by the 5/2 valve The valve actuation depends on the speed of the encoder and the timing given in HMI.

The setup of the rejection process is as follows,



Infeed conveyor – belt conveyor (1):



This setup has two belt drives which is parallel to the guides

of the tuck conveyor. The tuck passes through this setup which increases the gap between the successive tucks as the speed of belt drive is higher than the chain drive. This setup is powered by the induction motor. The rotation of the shaft is converted to 90° by using the bevel gears which are connected to the pulleys. The top guide is used to prevent the tuck from collapsing. The belts are used to evenly distribute the glue throughout the flaps.

Weigher:

There are 3 conveyors which are as follows;

1) In-feed conveyor
2) Weigher conveyor
3) Out-feed conveyor

In-feed conveyor:

It is used to increase the speed of the tuck. It is next to the in-feed belt conveyor-I. The in-feed conveyor is a belt conveyor which runs with the power generated by an inbuilt motor. The speed of this in-feed conveyor is higher, so that it maintains a 150 mm gap between each tucks.

Weigher Conveyor:

It is exactly a 150mm belt conveyor. The weighing of the tuck takes place at this pace. The Weigher takes few milliseconds to stabilize the weight of the tuck. The time taken to stabilize is equal to the time taken to travel 150mm belt conveyor.

Out-feed conveyor:

The Out-feed conveyor has two rejection bins which are as follows;

1) Overweight
2) Underweight

Out-feed conveyor is also a belt conveyor. The two rejection bins have one air purge setup each. Based on the number of blades in the tuck and the types of blades, the weight varies. So, for each types of blades and number of blades, a mean value is set and the tolerance is also set.

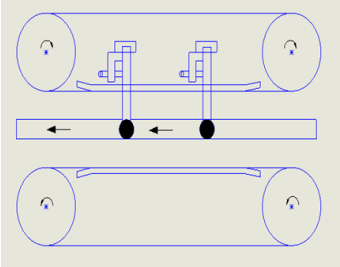
If the tuck weight is within the limit, the tucks are accepted and is sent to the next belt conveyor. If the tuck weight is under the limit, the tucks are rejected by the air purge and sent to the underweight rejection bin. If the tuck weight is over the limit, the tucks are rejected by the air purge and sent to the overweight rejection bin.

Weighr display:

We know that, there are different types of blades in Gillette such as; Wilkinson, 7'O Clock, 365 and also the tuck size varies as 5, 7, 10, 11 and 12. For each type of blade and tuck size, the mean weight value is set in the weigher display accordingly. The tolerance value for each weight, target weight and tare weight can also be set in the weigher display. The three conveyors, the display and its motors are connected together and it is mounted after the station 3. This weigher is the next station which is station 4.

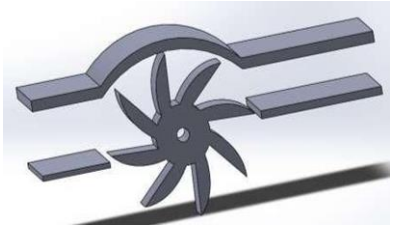
Output feed conveyor I: (Belt conveyor-1)

The output feed conveyor is placed next to the weigher output feed conveyor. It reduces the speed of the tuck. An induction motor powers the conveyor by using bevel gear mechanism. It reduces the speed of the tuck as well as increases the ejection force.



90° Flip & Unloading:

The tuck from the output feed conveyor hits on the curved edges of the 90°flip. This setup turns the packed tuck into 90° for easy unloading.



Unloading:

After the tuck is rotated 90°, the tucks are unloaded manually and are sent for sales.

3. Conclusion

In the earlier stages of developing the machine, the first setup of the blade dispenser was with the vertical magazine which had the problems of blades getting stuck and the wrapper tear out. To overcome this problem, the second setup of blade dispenser was developed with the curved tip magazine. As it had a micron level gaps between the blades, it was partially successful but even it had a problem of wrapper tearing and the stuck of blades. Finally, the third setup was developed with a unique idea of gearbox system with pusher unit. This is now believed to be successful and the blades are free from damages.

In tuck pick and place station, we had a larger trace of suction cup at all the three position. Due to this, the picking and placing was improper. This setup did not pick the tuck at required position. So, the whole function was collapsed in successive rotation. In order to overcome this problem, a new trace path is developed. This trace has very high accuracy in picking, opening and placing of the tucks.

Initially, gluing was done by spraying at two points of the

flap. As the distance between the two points was less and the time taken was also less. Hence, it was difficult for gluing at two points in a faster rate. So, the gluing was done by continuous shorter time. The glue applied for the shorter time is called as the beading. This beading was spread evenly throughout the flaps of the tuck.