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A CASE STUDY ON IMPROVING THE PRODUCTIVITY OF A PLANT (IMPERIAL AUTO INDUSTRIES LIMITED)

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ABSTRACT

Imperial Auto ltd (Pantnagar) is a company which manufacture different fluid transmission products (rubber hose assemblies, metal tube assemblies and flexible hose assemblies). At present situation the company is having less productivity due to various reasons. In this paper, to accomplish our objective by effectively utilization of plant area, changing in plant layout, process layout, reducing non-productive time, reducing defects and applying ergonomics for various working position.

KEYWORDS: transmission, assemblies, flexible, productivity, plant layout, ergonomics.

INTRODUCTION

There are various process involved in the manufacturing of a rubber hose. The processes includes extrusion, mixing milling, braiding and knitting, covering area, silicon covering, vulcaniser, washing, cutting, inspection, notching, printing, final packing.

From Extrusion to the final packing the material undergoes the above processes.

This rubber is made from materials like neoprene, nitrile epdm etc.

All the companies always want to improve their productivity continuously by solving the problems which abrupts productivity. So company want to produce more output by effectively utilizing the available resources; where Imperial Auto Industry Limited is also one

of them. Biggest problems which are associated with this company are ineffective layout, , material handling problem, improve cycle time, reduce waste movements and defects, ergonomics etc. so our main objective is to apply industrial engineering techniques to solve the problems which improves the productivity.

Objective of the Project Research

- To improve overall productivity of company by eliminating and minimizing the problems by increasing cycle time.
- To improve efficiency of the Plant layout by using various industrial engineering techniques.
- To improve the productivity of a plant by reducing the defects produced.
- To improve the productivity of a plant by changing working methods.
- To improve the productivity of a plant by changing layout of the certain area of the plant.

Processes

a) Extrusion: Extrusion is a process used to create objects of a fixed cross-sectional profile. A material is pushed through a die of the desired cross-section.

b) Milling

c) Tubing: Tube drawing is a process to size a tube by shrinking a large diameter tube into a smaller one, by drawing the tube through a die. This process produces high-qualitytubing with precise dimensions, good surface finish, and the added strength of cold working.

d) Knitting: Knitting is a method by which yarn is manipulated to create a textile or fabric for use in many types of garments.Knitting creates multiple loops of yarn, called stitches, in a line or tube. Knitting has multiple active stitches on the needle at one time.

e) Braiding: One or more yarns are twisted together to form a strand. Carriers are mounted onto a braiding machine, where the braiding takes place.

f) Covering: In covering area the knitted tube is passed through the machine to form the tube of given dimension and the coolant is provided to avoid heat at the covering place.

g) Vulcanisation: Vulcanization or vulcanisation is a chemical process for converting natural rubber or related polymers into more durable materials by the addition of sulfur or other equivalent curatives or accelerators. The tubes from covering area are brought to vulcaniser where they are mounted on various mandrels and then kept inside the vulcaniser for the specified time and when they come out the acquie the shape as that of the mandrel.

h) Washing: These tubes after vulcaniser go to the washing area for cleaning.

i) Cutting: After washing these tubes go to the cutting area where they are cut by keeping the pipe in the given fixture according to the given dimension.

j) Wrapping: In this process a tube is mounted on mandrel and after that wrapping of silicon takes place. These parts are sent to vulcaniser for futher processing.

k) Inspection: After the cutting the parts are brought to the inspection table where they are checked for the parameters like inner diameter, thickness, nail marks etc.

l) Notching: In notching the pipes are kept in a fixture and a die is punched on it.

m) Printing: After this the parts are brought to printing where the parts are placed on a conveyor and a punching die prints on the part.

n) Pad printing: In pad printing arrow marks are placed on the parts and the process is similar to printing.

OBSERVATIONS

Cycle time and calculations of above processes

S. No	Process	Specification	Cycle Time (seconds)	Rate (rev/min)
1.	Extrusion	Hollow size-7x14 Tube thickness-1.90x0.2 Die thickness-9.7mm		
2.	Mixing mill	Hollow size-24x33 Tube w-2.70+-0.2	12	4
3.	Tubing and knitting	Hollow size-14x21 Rayon(grey colour)	20	3
4.	Braiding and knitting	Hollow size -14x26	20	3

Now

Productivity=(No. of parts completed x standard)/(no. of employe x hours paid)

Efficiency=(No. of parts completed x standard)/(no. of employe x hours worked on product)

Working hours paid for - 6:00a.m. to 6:00p.m.i.e. 12 hours

Hours spent on manufacturing product = (12-1)=11 hours

1 hour =30 mins(lunch)+ 2x15(2 tea breaks)

so,

S. no	Process	Productivity (%)	Efficiency (%)
1.	Extrusion		
2.	Mixing mill	83.3	90.90
3.	Tubing and knitting	88.5	96.5
4.	Braiding and knitting	88.5	96.5

Vulcanizer

Cycle 1

S.no	Place	Process	Time taken
1	Vulcanizer 1	For covering	10 min
		For tighting	40 sec
		Inside machine	29 min
2	Vulcanizer 2	For covering	10:30 min
		For tighting	46 sec
		Inside machine	45 min
3	Vulcanizer 3	For covering	9 min
		For tighting	35 sec
		Inside machine	28min

Cycle 2

S.no	Place	Process	Time taken
1	Vulcanizer 1	For covering	11 mins
		For tighting	42 sec
		Inside machine	28 min
2	Vulcanizer 2	For covering	8 min
		For tighting	40 sec
		Inside machine	53 min
3	Vulcanizer 3	For covering	10 min
		For tighting	45 sec
		Inside machine	29min

Average time to remove pipes: 5 mins

Total time taken in:

One Process=39.7+5(removing pipes)=44.5mins

Second Process=61.6+5(removing pipes)=66.6mins

Third Process=39.75+5(removing pipes)=44.75mins

Cycle 3

Table-5.

S.no	Place	Process	Time taken
1	Vulcanizer 1	For covering	24 mins
		For tighting	40 sec
		Inside machine	31 min
2	Vulcanizer 2	For covering	10:30 min
		For tighting	46 sec
		Inside machine	51min
3	Vulcanizer 3	For covering	16 min
		For tighting	35 sec
		Inside machine	33min

Average Time to remove pipes: 9 mins

Total time taken in

One process=55.6mins+9 mins=64.6mins

Second process=62.2mins+9 mins=71.2mins

Third process=49.5mins+9 mins=58.5mins

Time difference between two days:

One Process=64.6mins-44.5

=19.5mins

Second Process=71.2mins-66.6

=5.5mins

Third Process=58.5mins-44.7

13.75mins.

The difference is due to the absence of worker during the 2nd day.

So, this is why multi skill labour is suggested at the latter reading of the paper.

Silicon Wrapping

S.no	Process	Time Taken
1	cuttting	35seconds
2	Wrapping(red1)	50seconds
3	Wrapping(red printed)	2 mins 20 seconds
4	Wrapping (red 2)	1min 32 seconds
5	Wrapping silicon	2mins 36 seconds

For one mandrel

Time taken =7 mins 8 sec ~ 8 mins for 1 mandrel.

Printing

S. no	Piece	Time wastage (in seconds)	Rate (piece/min)
1.	Type1	5	29
2.	Type 2	4.7	23
3	Type 3	12	18
4	Type 4	6	48

So, average rate comes out to be approximately 29piece/min.

Pad Printing

S.no	Part no.	Cycle time(piece/min)
1	5803	20
2	570m	26

Setup Time: 4 mins 30 seconds.

Average piece=23piece/min

Cutting

S. no	Name of the operator	Part no. or hollow no.	Cycle time
1	Bhagwan Singh	5804 5805	10 9
2	Ram Bahadur	5803	8 7
3	Inderjeet	5836	5 5
4	Dilip Singh	1458 5835	3 5
5	Rakesh	1700N	5

Time in changing the fixture and pouring a lot:

3mins 30 seconds.

Total available time =11 hours

=11x60=660mins~39600seconds.

Time in changing the fixture and pouring the lot:

3mins 30 seconds.

Time in bringing fixture down and other work:

=1 hour in a day.

Net available time =39600-6300=33300seconds~555mins.

Average piece in 1 min=6piece/min.

Total no. of pieces by 1 worker=3330

Inspection

S.no	Table no.	Cycle time(per min)	Defective
1	1	7 4	2 2
2	2	4	1
3	3	5	3
4	4	12	0
5	5	4	1
6	6	9	1

Total inspection=55pieces

Defective in 1 min=10

Ok piece=45

So pieces checked in 555mins =55x60x10=33,000.

Problem identification

1. In process namely extrusion, mixing milling, tubing and knitting and braiding and knitting the waste of man power is there in each process.
2. In a process called vulcaniser, defects occur because of nails.

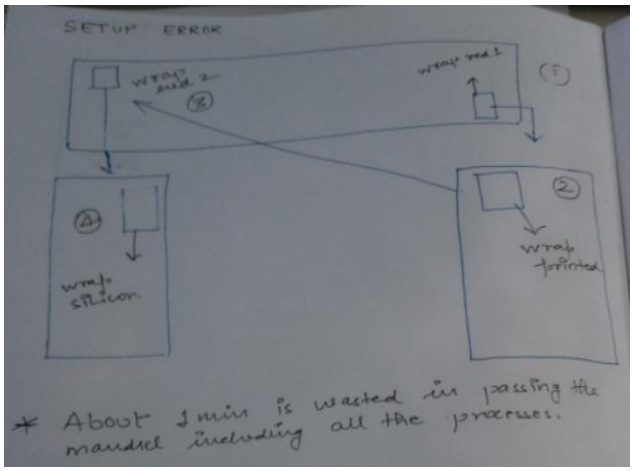
- A lot of time is wasted is discussing the matter. All workers gather to the supervisor when he asks something causing loss of production.
- A bin should be placed below corresponding to the respective pipe.
- The production goes down when a worker takes a leave.
- The vulcaniser takes too long for the formation and the release of the steam.

3. Time wastage from moving the pipes from vulcaniser to washing.

- 15 seconds each worker waste to keep the pipes in the washer and then come back again to work.
- So in total there are 5 workers on each vulcaniser so total time wasted =5x15=75seconds.
- As there are 3 vulcaniser, so total time wasted =75x3=3 mins and 45 seconds in each cycle.

  This type of waste is an example of time and motion waste from Time wood (7 Types of waste).

4. The following error is there in the silicon wrapping area.



5. There arises a problem in notching too.

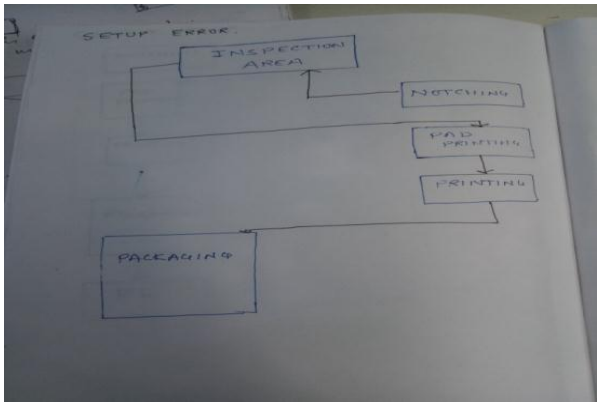
- In some pipes, the thread is coming out of the pipe on punching.
- A large amount of time is wasted in finding the position of the punching.

6. The rework area has a stock compiled.

7. The piped often get mixed in bins and is difficult to relocate the required pipe.

8. In cutting process, a fixture has to be brought from a place too far from the working area so a lot of time is wasted in doing so.
9. For all the three vulcaniser, only one washing area is there which is far from vulcaniser 2 and 3.
10. No updation of inventory.

11. In transporting FG to store, no indication made for which material belongs to which company. It causes loss of time in locating the material.
12. Layout problem in inspection, printing and notching area which is shown below.



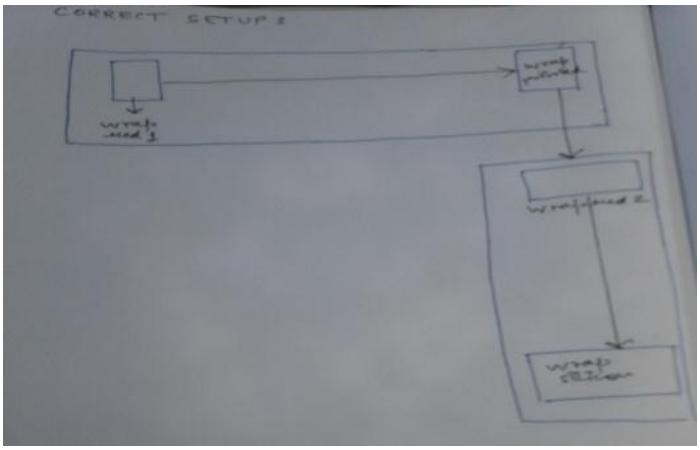
Improvements

1. Instead of manual roller, a motor can be placed to move roller and this man can be utilized in some other work process.

2. To avoid the defect caused by the nails, an improvement can be done that at the gate the nails od each worker should be checked before entering the gate.

- First 10 mins can be allowed to pass on the information to the supervisor one from each vulcaniser so as to reduce the loss of productivity.
- The box corresponding to the respective pipe should be placed below it.
- A group of multi-skilled labour should be employed so as when the worker takes a leave, the production should not go down.

3. Each vulcaniser should have its own washing area so as to reduce the wastage of time and motion.
4. The corrected setup of the point 4 is shown below:



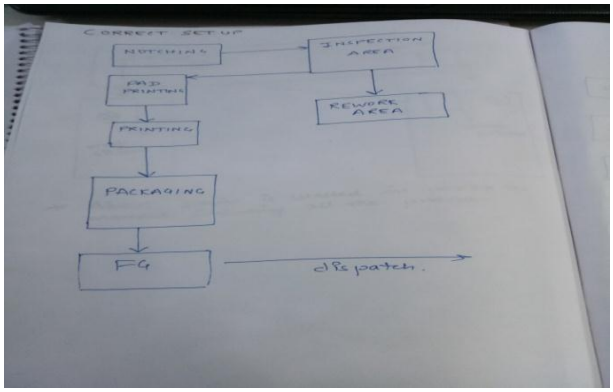
5. The notching bit should be maintained immediately to avoid the threads coming out of the pipe on punching.

6. More labour should be employeed at the rework area so as to clear the stock as soon as possible. Only one labour is there so it has to be increased.

7. The bin should be provided with the photo of the pipe from all the four side of the bin so it will save the time of relocating the pipe and pipe can be identified at larger distance.

8. The fixture area has to located somewhere near the cutting area so it becomes easy and fast to carry the fixture to the working area as soon as possible.
9. An arrangement of individual washer for each vulcaniser.
10. The worker has to be motivated at regular intervals so that he can work with full commitment.

11. Each worker has to be provided with certain goal for the day and if achieved he should be rewarded for his work. This will create a feeling of healthy competition between the worker which will help in increasing the productivity and the industry will flourish as a result of the same.
12. The correct setup for the point 13 is shown below.



CONCLUSION

This paper discussed the problems occurring in a manufacturing plant due to which its productivity is low. Also it discusses the improvements which can be done to eliminate these problems so as the increase in productivity takes place.

The solution for various problems are being discussed in the paper. The efficiency of the worker can further be achieved by motivating them.

Hence, such problems arise in the small scale industries can be minimized by using industrial engineering techniques.

REFERENCE

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