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A REVIEW: "ENERGY PERFORMANCE IMPROVEMENT USING AUTOMATION AND CONTROL APPLICATION IN FILLING LINE OF PAINT INDUSTRY"

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ABSTRACT

Liquid filling operations nowadays in manufacturing industries is done by semi automatic machines. To get higher productivity and to reduce production cost, there is a need of fully automatic machines. In India In leading paint manufacturing industries semi automatic machines are used. Existing semi Automatic liquid filling line used in industries consist some manual operations for example if spillage of the cans occurs during the paint filling operation then there is no provision to stop the can feeders stations, where cans are feeded manually due to this can feeder runs unnecessary which results in wastage of power. Several such other unnecessary operations create huge power loss and hence there is need of energy performance improvement using automation and control application in such paint filling stations. Automation is done with the help of inductive sensors & programmable logic controller. Inductive sensors are used to sense the unnecessary movements with in paint filling stations & suitable modifications is done in PLC to make lines energy efficient. Many times manufacturer produces machines which are only cost effective & much attention has not provided on the running coast incurred by machine over longer period of time. With this project , we have analyse & suggested modifications in the existing paint filling machines which helps the manufacturer to reduce the electric consumption of machine.

KEYWORDS: Liquid filling operation ,programmable logic controller, paint manufacturing industry

I. INTRODUCTION

In current scenario in highly competitive industrial world, industry must be cost effective for existence hence energy performance improvements and industrial automation acquired major attention to reduce the cost of production and to increase the productivity. The main objective of this project is to conserve the electricity by using automation technique. In each stage of paint filling stations unnecessary running of lines avoided with addition of inductive sensors and Programmable logic controller which results in huge saving of power. Existing Semi automatic filling machines includes the filling operations & printing operations. Below mentioned information gives complete information regarding each station and functions of each part associated in the line. The research was carried out at manufacturer place to have close observation on each process to reduce the unwanted operations which ultimately resulted in to electricity saving.

Structure of paint filling machines

Can feeder 1: It is a rotary type table operates on a 3 phase motor drive with 5 rpm speed and used to feed empty cans to the system.

Can feeder 2 : It is another rotary type table operates on 3phase motor drive with the speed of 50 rpm and used to feed empty containers to the system.

Can Orienter conveyor 1: It is a linear motion conveyor operates on 3phase motor drive with the speed of 18 m/min and used to convey cans from can feeder to intermediate table.

Can Orienter conveyor 2 : It is another linear motion conveyor operates on 3phase motor drive with speed of 18 m/min and used to convey cans from can feeder to intermediate table.

Can Orientor (Printing) with UJ Mark Detect Camera : This unit is used to rotate cans for printing manufacturing data i.e. price, date & address etc.

Print Check unit (2 Nos.) : It is nothing but a camera which is used to inspect printing accuracy while can is rotating in can orientor.

No Print Can Rejecter [Air Jet] with Collection Bag (2 Nos.) This device is used to reject cans from line, if can is found without printing or wrong printing.Once can without printing detected in print check unit, it gives command to 'No print can rejecter' and it gets activated.

Intermediate Feed Table,It is a rotary type table operates on 3 phase motor drive with 50Hz frequency. This unit is used to feed cans from orienter conveyor to indexing conveyor.

Indexing Conveyor This unit used to convey cans in steps at defined pitch. It is driven by servo motor for speed as well as accuracy. It contains 20 stations.

Reverse/Fallen Can Detector This device used to identify the fallen can before filling.If any fallen can comes at this station it detects and indexing conveyor stops.

Check weigher It is a load cell station 1 used for check weighing & it is calibrated for desired weight accuracy. It shows net weight of liquid whereas container weight is already stored in PLC memory.

Lid dispenser This electro pneumatically operated device is used to dispense lid on filled cans. Lids are placed manually on lid stack holder then lids are picked from stack and placed on filled cans with the help of rotating arm consist of suction cup and pneumatic cylinder

Lid Press with No Lid Check & Bottom Shade Dotting. Dispensed lids are loose on containers hence in order to press it against can lid press is used which generates pressing force by heavy duty pneumatic cylinder. No lid checking is operation done at the time of lid pressing which gives signal to system if there is no lid on can. Bottom shading is operation for printing shade dot at bottom of can if needed (mostly used in paint industries)

Can Rejecter with Rejecter Conveyor If container with 'Low weight' or 'No lid' is detected then it is rejected automatically on rejector conveyor form line with the help of can rejector

Can Accumulator.It is a rotary type table operates on a 3 phase motor drive with 5 rpm speed and used to accumulate containers coming out of line

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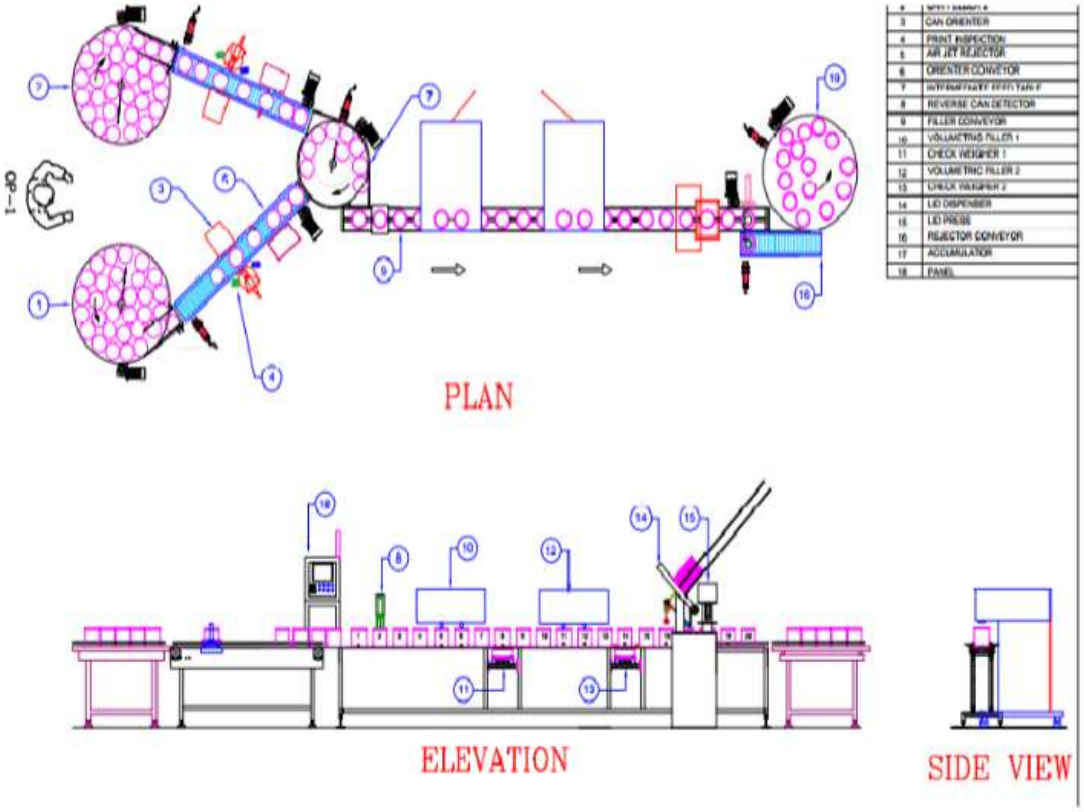

Fig 1.1 Paint filling Station

II. REASONS FOR WASTAGE OF ENERGY IN EXISTING PAINT FILLING STATION

- Can feeder runs continuously if there is spillage occurs in the filling station.
- On accumulation at intermediate feed can feeder does not stops
- Orientor conveyor does not stop if there is spillage of can
- Paint filling station doesn't stop in idle mode
- Volumetric filling stations consume more power because of two cylinder arrangements.
- Existing accumulator table is rotary which needs manual pick up for storage

III. LITERATURE REVIEW

Semi automatic paint filling stations need close observations to identify the unnecessary running operations and if it is modified with the fully automation techniques then huge power saving is achieved.

D.Baladhandabany, S.Gowtham, T.Kowsikkumar and P.Gomathi et al. 2015 [1] Published in their research that there is huge energy saving opportunities lies in the PLC based fully automatic machines. Automation systems are used to increase productivity, which in turn brings economic progress. The main purpose of PLC in automation is used to control the whole system. The cost of installation is not cheap but it can efficiently run for a long period of time

Prof. Swapnil R. Kurkute1, Mr. Akshay S. Kulkarni2, Mr. Mahesh V. Gare3, Mr. Soham Mundadasystem et al 2016[2] carried out technoeconomic analysis on liquid filling operations & concluded that PIC controller, ARM7, Microcontroller, PLC and SCADA also used to make the system energy efficient .

IV. PROPOSED FULLY AUTOMATIC ENERGY EFFICIENT PAINT FILLING LINE

In the proposed system from first station efforts are applied to bring down the cost and energy consumption of the line. Inductive sensors are added at the entry point of the orienter conveyor, .if the cans remain there infront of the sensors above predetermined time period then it will give feedback to PLC to stop the can feeder.

- In existing line Can feeder are running continuously so to avoid this Sensor added at orientor conveyor entry, in order to reduce the energy, when sensor on can feeder gets off & when sensor is in off can feeder gets on, which reduce the electric consumption.
- Secondly On accumulation at intermediate feed can feeder does not stops. To avoid such situation Extra sensor added at orientor conveyor end, in order to reduce the energy, when can passes through sensor it takes count stops the can feeder
- On accumulation at rejecter can feeder does not stops , In modified system Accumulation at rejecter=rejecter pusher count taken
- On accumulation at accumulator feed can feeder does not stops hence by providing sensors the electrical consumption have reduced significantly.
- Accumulator table instead of round, Roller type can be made
- Machines does not stops in idle mode, Power saving mode enabled if machine runs in idle for more than 5 min than it stops.
- Volumetric unit for paint filling, Wighmetric filling is used to save energy

V. CONCLUSION

With the help energy consumption date we will determine precisely electrical consumption of existing system and will proposed the modifications proposed system. After using modified system we can eliminate the unnecessary running of line & during idle hours, which results in huge saving of electrical consumption of the line. For this we will give logic to the PLC to change the programme in PLC to stop the unnecessary movements of can feeders & intermediate feeder, orienter conveyor etc. Instead of using existing volumetric filling system we will modify line by using weigh metric system which will reduce the air consumption & ultimately reduces the compressor power consumption. With proper condition monitoring at each level significantly reduce the electrical consumption. Weighmetric system consist of load cell arrangement which detect the weight of filled can & automatically gets cut off if the required quantityis filled in the can. After doing detail study on working of paint filling lines used in packaging industries, we can say that there are thousands types of automatic lines are running in packaging industries and thousand numbers of such conditions are generated from which tremendous amount of energy is being wasted. Hence, here I can conclude that by doing detail energy consumption study on every electro pneumatic operating system, we can minimize the energy consumption which will help for lowering energy demand in that particular field which helps to save precious energy and we can divert this power to the needy especially in the rural areas of our country where energy supply is still inadequate. With the help of suggested modification we c**an** improve the efficiency of the filling line & reduce electricity consumption which ultimately saved the cost of production and ultimately customer benefited.

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