



Increase of efficiency and profit margin of NPK plant by improving the feeder conveyor

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ABSTRACT— Main stream agenda of the industries is to meet the production demand with high efficiency. The easy way achieving this is by improving the feeder conveyor. In the existing method flow in the feeder conveyor is controlled by changing the speed of the conveyor driving motor using electronic frequency controller (EFC). The gate valve is manually operated. In this method the efficiency of the system is reduced and more cost due to EFC. To overcome this in the proposed methodology we remove the EFC and automate the gate valve. The motor speed is constant. The gate valve actuated by actuator piston. The gate valve opening is set as per the demand. A load cell is used to measure the weight of the material. Load cell sends signal to the microcontroller controller. The microcontroller control the level of the gate valve as per the requirement.

Keywords— gate valve, Microcontroller, load cell, EFC, piston.

1, INTRODUCTION

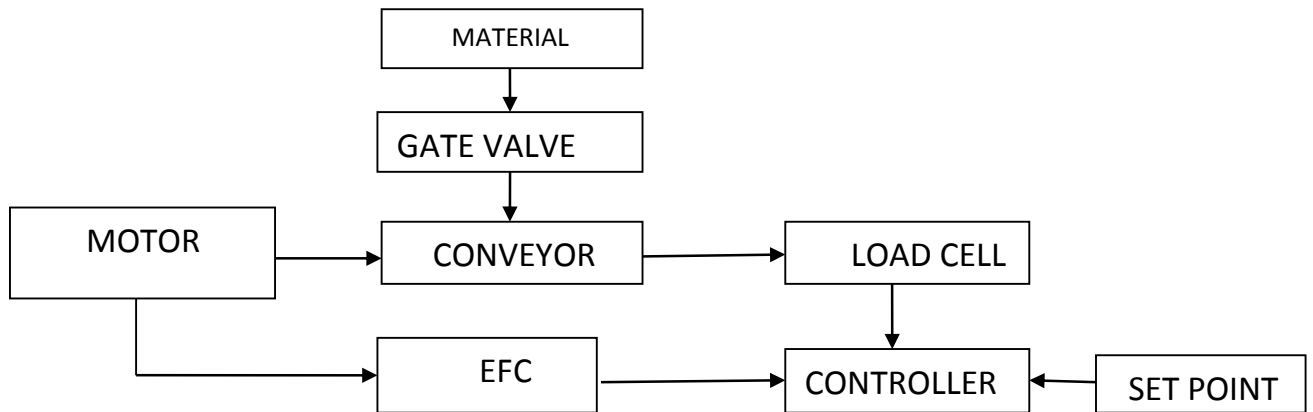
In the manufacturing industries the production demand of the day meet by controlling the flow in to the feeder conveyor. Many of the industries does not use a efficient way of controlling the flow. By improving the feeder conveyor system we get more efficiency and loss is reduced. In the existing methodology the flow is varied by changing the speed of the conveyor motor. The speed controlled is done by EFC(electronic frequency control) method. The gate valve is manually operated. The level of gate vale is kept constant and speed is varied. EFC varies the frequency to vary the speed of the motor. The drive also regulates the output voltage in proportion to the output frequency to provide a constant ratio of voltage to frequency, as required by the characteristics of AC motor to produce a torque. A load cell is used to measure the weight of the material. The load is connected to the PID controller. The controller sends the signal to the EFC to change speed of the motor to as per the set point. This technique has more lose and high cost. To overcome this in the proposed methodology we remove the EFC and automate the gate valve. The motor speed is constant. The gate valve actuated by actuator piston. In this method of controlling the feed rate according to the demand, the weight of the conveyor is measured using load cell. This signal is given to the PID controller. The PID controller minimize the error to the set point. And this signal is given to actuator piston. It sets the gate valve level as per the set point. the piston Is actuated by the pneumatic signal. The controller gives the low level pressure which is amplified and gives piston. Load cell here used is strain gauge load cell.

It continuously measures the weight of the material and sends to the controller. In this method efficiency is improved. And it has very high accuracy that will reduce the material loss.

2, EXISTING METHODOLOGY

The existing methodology in the industry is to feed the material in the conveyor and the gate valve is manually operated such that a constant level of material is maintained. The maximum material requirement per day is about 10 to 15 tons respectively. The weight of the material is measured with the help of load cell. The load cell used here is Strain gauge load cell. . Therefore by keeping the level of the material constant , the speed of the motor is varied to meet the production requirement. The motor used here is Three phase AC induction motor and it is also called as Squirrel cage induction motor and are most frequently encountered in industry. The speed of the motor is measured and the values are sent to the controller and the output of the the controller is given to Electronic Frequency Controller(EFC).

BLOCK DAIGRAM



2.1 Controlling Of Electronic Frequency Controller(Efc).

Thus EFC or Variable Frequency Drive are used more and more to control the speed of induction motor to meet the production requirement. Variable Frequency Drive controls the speed of an AC motor by varying the frequency supplied to the motor. The drive also regulates the output voltage in proportion to the output frequency to provide a constant ratio of voltage to frequency, as required by the characteristics of AC motor to produce a torque. A Variable frequency drive has 2 stages of power conversion, a rectifier and an inverter. The rectifier is a circuit which converts fixed voltage AC power to either fixed or adjustable DC Voltage. The inverter is composed of electronic switches (thyristors or transistors) that switch the DC power on and off to produce a controllable AC power output at the desired frequency and voltage. A regulator modifies the inverter switching characteristics to that output frequency can be controlled. It may include sensors to measure the control variables. In closed loop control, a change in demand is compensated

by a power and frequency supplied to the motor, and thus a change in motor speed(within regulation capability).

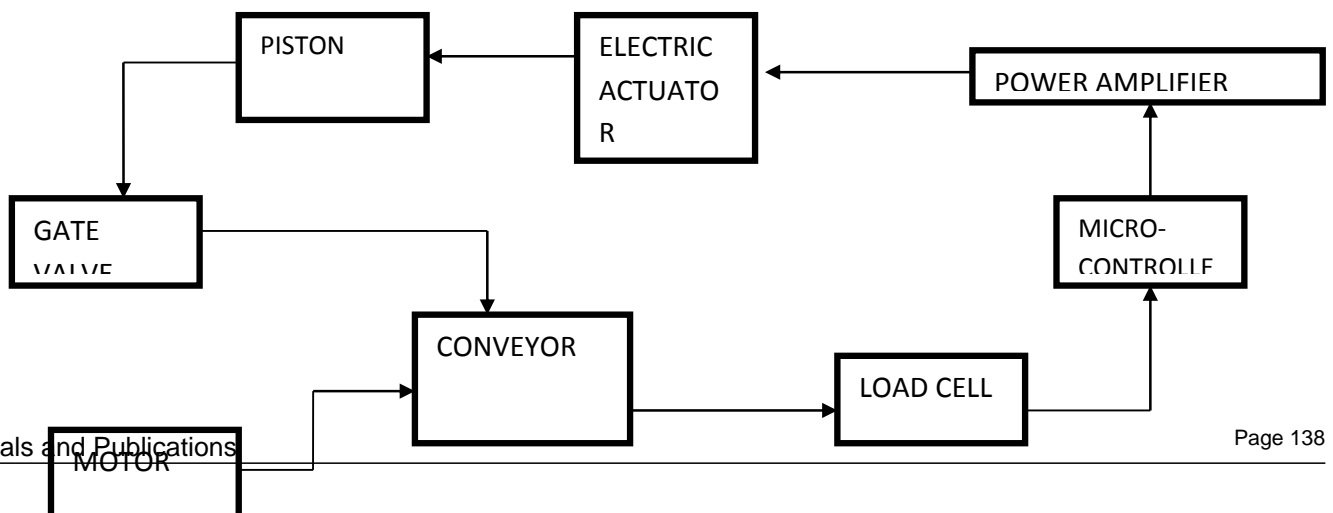
3, PROPOSED SYSTEM

In our proposed system we replace EFC (Electronic Frequency Controller) with automated gate valve. Since EFCs cost is high and the measuring accuracy of EFC is not satisfied. Due to the inaccuracy caused by the EFCs, The signal given by the EFC to the driving motor which drives the conveyor is inaccurate. Thus we have proposed this to eliminate EFC and instead we automate the gate valve according to the demand requirements. The driving speed of the conveyor is kept constant for maximum load. Since the load acting on the conveyor reduces the speed, Hence the load is measured using load cell. Here we use strain gauge load cell. The strain gauge load cell converts a force or load into an equivalent electrical signal or load value. This value is send to the microcontroller where the microcontroller program calibrate the value equal to set point. The 8-bit INTEL 8051 microcontroller is used as controller. The signal from the controller is send to the power amplifier to boost the voltage. This voltage is given to the electric actuator to move the piston. The conveyor speed is calibrated such that it withstands the maximum demand..

3.1 IMPROVEMENT OF GATE VALVE

A valve is a mechanical device that controls the flow and pressure within a set point of a system or process. The function of the gate valve is to regulate the flow of the material passing. Firstly the weight of the material which is passing through the conveyor is measured by the load cell and this signal is given to the Controller and the controller compares the process variable and the set point and generates a signal to the an electric actuator which is powered by a motor that converts electrical energy into mechanical torque this torque is converted to the linear displacement through mechanical transmission to provide straight line push/pull motion of the piston. Thus the actuator moves the gate valve according to the set point. Thus the accurate opening of the gate valve gives the improved technique for managing the demand of the plant. Thus at the maximum demand, the gate valve is opened 100% and if the demand rate is reduced the gate opening is also reduced.

3.2 BLOCK DAIGRAM



4, System Analysis Of Proposed Methodology

in the existing system the level of the gate valve is kept constant and speed of the conveyor motor is varied. The speed is controlled by using the EFC. But in the EFC controlling there are many draw backs like, At the high speed there is unwanted frequency is produced due to the skin effect this skin effect will tends to reduce the surface area of the flow. The higher frequency will produce more heat and create a heavy loss. This draw backs are reduced by automating gate valve the controlling of gate vale will increase the efficiency it will be low cost compared to the existing method. It requires less place as compared to the EFC. Actuation of piston is easy process. It requires low power consumption

As the cost and efficiency is major issue the automation of gate valve is more suitable for the MFL (madras fertilizer limited) industries.

VIII. CONCLUSION AND FUTURE WORK

Hence it been theoretically proved the EFC has many draw backs and it reduces the efficiency and also it requires high cost for the installation and maintenance. In the industries the increase of efficiency and meet the production demand is main issue. So by automation of the gate valve the efficiency is increased and installation cost is low for the gate valve. The electrical actuator is most easy process way to actuate

For future work the controlling process can be carried in internet of things(IOT). The data are stored in a separate server it can access from any where in world its is more secured way storing the data which can be viewed for the future work.

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