Research Journal of Engineering Sciences E- ISSN 2278 – 9472
Vol. **5(4),** 30-35, April **(2016)** *Res. J. Engineering Sci.*

Process Linked with Plate Mill and Development of Data Acquisition System to Display Process Parameter

Rathia Narendra* **and Dewangan Chitesh Kumar**
E and TC Department, BIT, Durg, India
narendrarathia11@gmail.com

Available online at: www.isca.in, www.isca.me
Received 24th February 2016, revised 4th March 2016, accepted 20th April 2016

Abstract

In plate mill process parameters are required to keep under observation for proper operation of industrial plant and all the parameters like temperature, gas and pressure should be within the limit and it should not go beyond the limit which would become hazardous for those who are working in the plant. So for this we need to develop a data acquisition system to properly observe all the process system of one plant. It will be very useful in compilation of data and training purpose of staffs. The system going to be designed consists of potentiometer, analog to digital converter, microcontroller and computer. All parts of the system perform the task in a combined way. The potentiometer converts the electrical input as output voltage, and hence the analog to digital convert the output voltage signal in digital or discrete form so that it can be given as input to microcontroller and hence the data are manipulated based on the program burned in it. In this way we can implement a simple instrument of low cost, which also can perform the work as in plant. This can be easily achieved with simulation software. We can keep our parameters controlled through this system and it will be more beneficial in safety and efficient in manufacturing point of view. So for this project I would develop a DAS (Data Acquisition System) using microcontroller with serial bus communication for collecting and monitoring data on central process computer.

Keywords: Microcontroller, Potentiometer, Plate Mill, DAS.

Introduction

The modern instruments used are plc based which are very much sensitive and fast responsive[1]. This is very useful but there is use of sensors and transducers. The transducer and sensor used are very costlier and hence it becomes costlier to the plant. Here we can develop a data acquisition system with the help of potentiometer to reduce the cost. It will be also more useful to us because of its easy available and cheap. Also the data acquisition system used in the plant will be centralized hence number of instruments and more number of plc required is reduced. Here we can control the whole plant from a single point easily and more efficiently. The system installation will be easier. Here we need microcontroller, analog to digital controller, potentiometer etc. Bhilai steel Plant, Bhilai was observed for this project work. Here we observed plate mill, which is actually an elaborate process.

Plate Mill: Plate mill is linked with the process of formation of plate from slab. Slabs are the cuboidal body of steel. These are manufactured in SMS-1 and SMS-2. The product of SMS-1 and SMS-2 are blooms, slabs, rails etc. Slabs are used to prepare plate hence these slabs are sent to continuous casting shop. The slabs in this shop are prepared to proceed for plate making process. Hence in plate mill these slabs are prepared as plate using various process like reheating, descaling, rolling, cooling, leveling etc[2].

Reheating Furnace: In this area the slab i.e. cutting part of iron plate, is brought here from sms-2. Reheating furnace diagram shown in Figure-1. The iron slab is manufactured in sms-2 and hence the slab is sent to plate mill to reproduce plate of required dimension. The slabs are reheated in the reheating furnace and hence it is heat till rolling temperature. The slabs are heated in reheating furnace up to 1200 to 1400^0C. The slab of this temperature can be used to form sheet of any dimension. The parameter for this plant is mentioned in reheating furnace parameter table. There are three zones in reheating furnace. They are pre-heating zone, heating zone and soaking zone. Parameters are given in Table-3.

In pre- heating zone the slabs are heated to a mild temperature. And in heating zone slab are heated up to rolling temperature. After passing through this zone slabs are sent for vapors cooling. Hence after this process the slabs are ready for sheet making process. Hence the reheated slabs are discalced; in this process the scales formed on slabs during reheating are removed by forced spray of water.

Vertical Stand- This is the rolling stand mounted vertically, to control the width of the slabs coming from descaling process. Hence we maintain the width to desired width in this section in CP-8. Here the temperature is maintained up to 1000^0C.

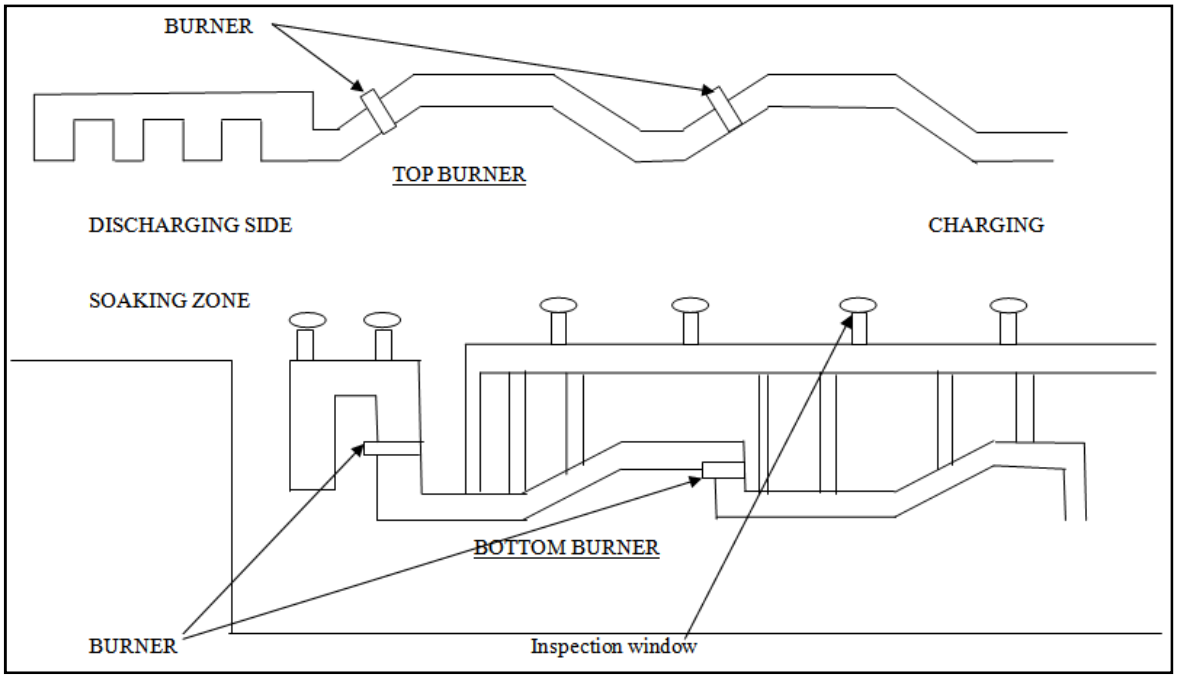

Figure-1
Reheating Furnace Parameter

Roughing Stand: Roughing stand controls the thickness of plates upto 26mm. And in this zone the temperature is maintained up to 960^0C in CP-9 because here we need to roll the plate to get thinned up to required thickness.

Finishing Stand: In this stand the plates from roughing stand is thinned up to required thickness and we can get minimum thickness of 8mm. Here the temperature is maintained in CP-11 at 575^0C.

Propane Plant: In propane plant, propane gas is stored in liquid form. The gas from source is brought through tanker vehicle. The gas in tanker is in both form i.e. liquid and gas. The gas is in both liquid and gas form because there is jerking in tank due speed breaker or pit in road. Hence there is pump and vapors compressor to empty the tanker and fill gas in propane tank. Gaseous form is emptied through vapors compressor and liquid form through pump. Parameters in the propane plant are given in Table-1. Diagram shown in Figure-2.

Gas Mixing Station: The gas mixing station (GMS) is the station where more than one gases are mixed in definite proportion in the plant. Here in GMS in BSP blast furnace gas and coke oven gas are mixed in the ratio 1:2.25.The mixed gas is now supplied as fuel to the different area in plant e.g. plate mill, gas cutting machine etc. The parameters in GMS are given in Table-2. Also propane is used as fuel. There is valve placed in between pipe of different gases and hence using this valve we can control the flow of gases in pipe line.

Normalizing Furnace: Normalizing Furnace is the final stage of plate mill. Here the plates are continuously reheated at different temperature zones. This method of heating provides strength to the plates. There are nine temperature zones in this section. Each zone is having its own specific temperature. And the plates are passed through it. Each zone is in a single line arranged one by one. And hence there is only one entrance and one exit. The gas and air this zone is controlled by the blower and Id fan. The ratio of air and fuel gas is feed inside feed inside the zone. Parameters are given in the Table-4.

Table-1
Propane Plant Parameter

Parameter name	Process value	Expected value	Reason for choosing parameter
Tank Temperature	(29) deg. cent.	It is ok.	To maintain the temperature of tank
Fluid level in the Tank	(2900) mm	It is ok.	To maintain the supply of fuel.
Pressure	(10) kg/cm^2	It is ok.	To maintain the vessel pressure, excess pressure will blast the tank.

Water Pump House: Water pump house is must in plate mill because the water is used in cooling; it is also used in descaling process etc. The level of water should be maintained regularly at pump for continuous supply in different area as per requirement.

Pump Accumulator System: This section of plant is responsible for maintaining the pressure of water in the supply line. Here we also check for the pressure requirement in the supply line.

Furnace: In this section of Plate Mill the plates coming from leveling are strengthened by passing it from a nine temperature zones having different temperature specification given in table.

Potentiometer Fundamentals

A potentiometer is a device used in electrical circuits for providing variable resistances in the circuits and hence the variable voltages. The potentiometer is a resistive strip inside it through which we can adjust the quantity of resistance or voltage to be passed in a circuit through it. Potentiometer has three terminals in which terminal E is connected to 5v supply, terminal G is connected to ground and terminal F is used as output terminal to get variable voltage. We can use potentiometer as input in many electronic circuits to get desired voltage between (0-5) v. Hence, the potentiometer can be used as transducer or sensor in circuits to display the change in displacement of terminal F as the change in resistance or voltage as electrical output. Diagram shown in Figure-2.

Control Scheme

In this era of fast responsive technology we need to develop a system which is more efficient, more reliable and of low cost[3]. We can develop a data acquisition system to control the parameters of plant using potentiometer, analog to digital converter, microcontroller, serial port communication part and computer[5]. Hence system similar to PLC system can be implement to perform the same task with low cost and more efficiently[6].

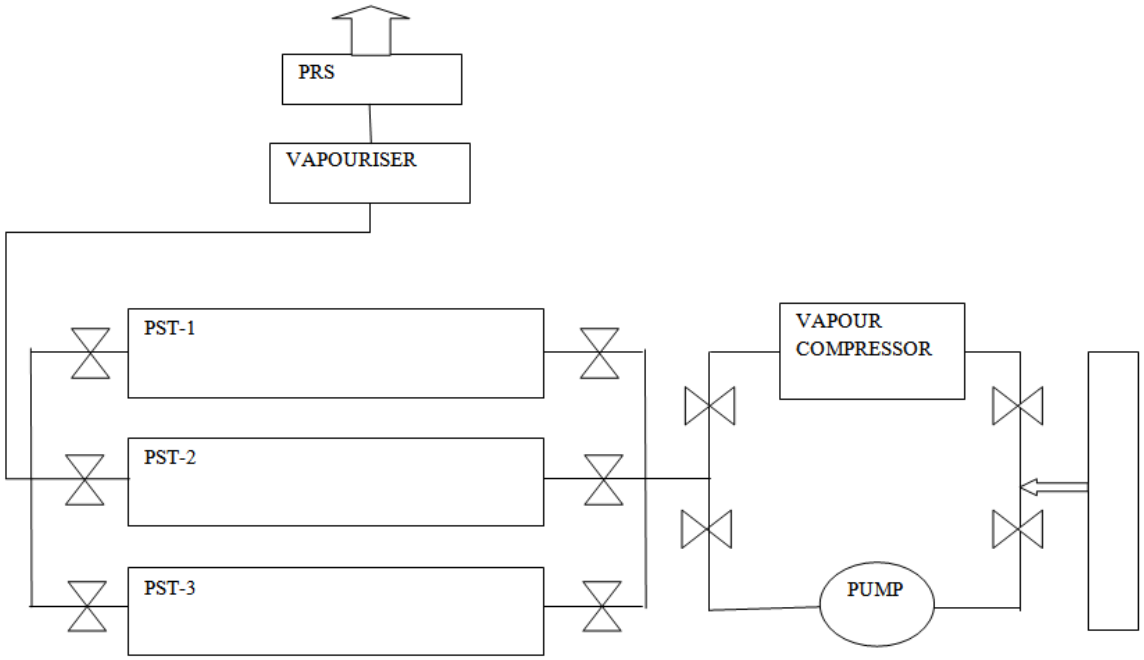

Figure-2
Propane Plant Diagram

Table-2
Gas Mixing Station Parameter

Parameter name	Process value	Expected value	Reason for choosing parameter
Blast Furnace Gas Pressure	380mmWc	It is ok.	Useful in gas mixing process.
Blast furnace Gas flow	(460-620) m^3/hr	It is ok.	Useful during gas mixing.
Coke Oven gas Pressure	(540-560) mm Wc	It is ok.	Useful in gas mixing process.
Coke Oven gas flow	(660-700) m^3/hr	It is ok.	Useful during gas mixing.

Table-3
Reheating Furnace Parameter

Parameter name	Furnace-1		Furnace-2		Furnace-3	
	PV	MV	PV	MV	PV	MV
TPHZ TEMP.(˚C)	35	34.1	1258.5	1183	1216	1210
THZ TEMP.(˚C)	19	27	1306.6	1285	1328	1328
BPHZ TEMP.(˚C)	30	48.9	1176.9	1165	1206	1209
TPHZ AIR FLOW(M^3/HR)	35	0	681	136	1160	904
THZ AIR FLOW(M^3/HR)	02	9.9	563	212	1057	570
BPHZ AIR FLOW (M^3/HR)	-07	-0.9	1120	568	1730	1186
BHZ TEMP. (˚C)	28	25.2	1275	1326	1285	1340
BHZ AIR FLOW (M^3/HR)	29	-0.001	846	340	1325	7398
BHZ GAS FLOW (M^3/HR)	1	24.8	266	126	433	238
SZ TEMP.(˚C)	25	44.7	1258	1321	1306	1310
SZ AIR FLOW (M^3/HR)	3	0.001	444	662	425	231
SZ GAS FLOW (M^3/HR)	01	-0.001	179	144	105	56
TPHZ GAS FLOW (M^3/HR)	1	0	53	10	308	184
THZ GAS FLOW (M^3/HR)	-2	-9.9	141	28	208	52
BPHZ GAS FLOW (M^3/HR)	63	0	400	114	650	357.5

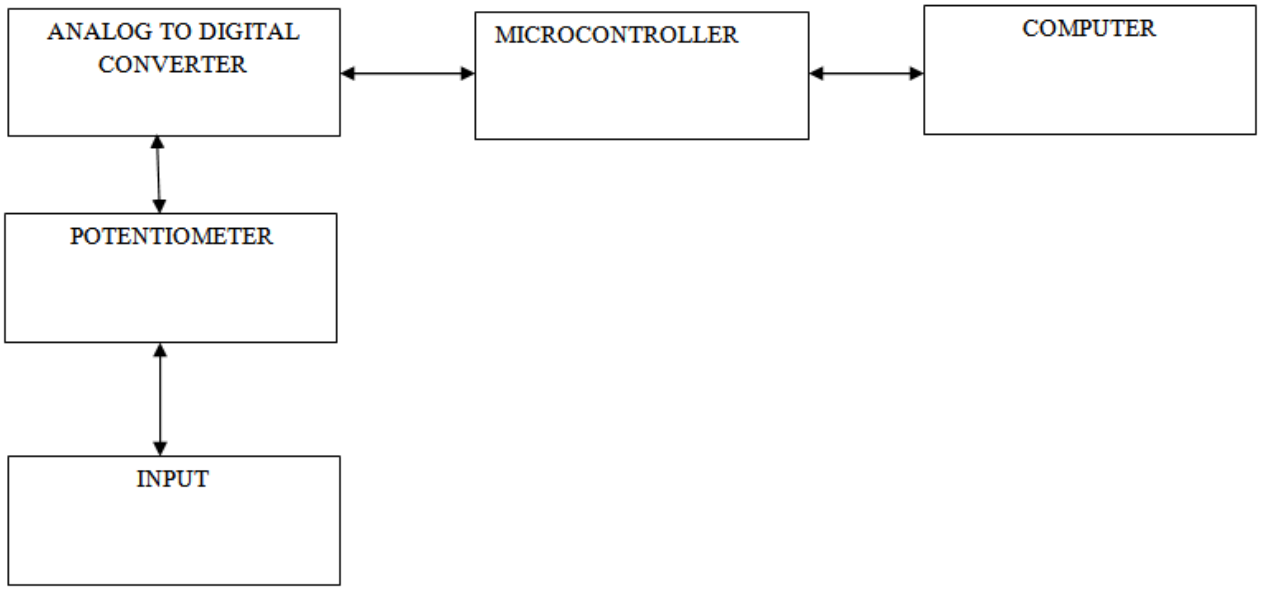

Figure-3
Proposed Methodology Diagram

Table-4
Normalizing Furnace Parameter

Parameter name	Normalising Furnace Air Pressure (Kg/cm^2)		Normalising Furnace Gas Pressure (Kg/cm^2)		REASON FOR CHOOSING PARAMETER
	Process value	Expected value	Process Value	Expected Value	
Zone no. 1	Not ok.	2170	636.8	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no.2	Not ok	3740	1177.02	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no.3	Not ok	2860	Not ok	999	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no.4	Not ok	1600	435.375	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no. 5	Not ok	1390	321.6	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no. 6	Not ok	1400	544	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no. 7	Not ok	150	Not ok	38	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no.8	Not ok	420	Not ok	005	The Rolled sheets are reheated at different temperature zone to give strength.
Zone no.9	Not ok	586	313.74	It is ok.	The Rolled sheets are reheated at different temperature zone to give strength.

So we can implement a simple system using potentiometer, analog to digital converter, microcontroller, serial port connection system and computer system to control the same task. Basic connecting block diagram is shown Figure-3. Hence we can prepare the system using components described above to implement the same system with low cost and more reliable. The potentiometer can be used as sensor to sense temperature, pressure; flow etc. and rest of the components are same[9]. Hence it will also give approximately the same output.

Conclusion

The aim of this paper is to make industry more efficient working using simple instruments. This will help not only the industry but also the people because of its easy operation. Maintenance and cost of repair or replacing will be cheaper. Parameters will be directly displayed through electrical signal to cost of transducer. It will be also beneficial in modern application like alarm system can be implemented or it can be integrated with other processes. Monitoring Parameters are costlier in plant hence it will reduce cost. Maintenance cost of local display at field is high hence it overcomes all those problems.

Acknowledgements

My greatest thank to Dr. Manisha Sharma, Head of the Department Electronics and Telecommunication Engineering, Mr. S.R Jatrele, AGM in Plate mill (Instrumentation) of Bhilai Steel Plant.

References

1. ACIDA (2014). Report on Torque Measurements and Process Analyses at the Heavy Plate Mill of Rolled Products Inc. USA.

2. Antonmio Augusto Gormi (1997). Application of Neural Network in rolling of plate mill. JOM-e.

3. Atiqur Rahman Chowdury, Mohammed Mynuddin and Mohammad Alamgir Hossain (2014). Process Control Using Microcontroller. *IJMES*, 2.

4. A. Wolf, H. Krambeer, M. Jelali, T. Seising, U. Muller and W. Agerer (2002). Multivariable command and control of thickness profile, chamber and flatness by topometrical measurements. published.

5. Gopil Singh, Kanak Chandra Sarma and Nungleppam Monoranjan Singh (2012). Design and Development of Low Cost Multi-Channel USB Data Acquisition System for the Measurement of Physical Parameters. published.

6. P.S. Chauhan (2013). A Case Study of the Effectiveness of Rolling Process to Manufacture the Strip of Leaf Spring. *IJMMM,* 1.

7. S. Rajesh Kumar, (2013). Industrial temperature monitoring and control system through ethernetlan. published. *IJECS*, 2.

8. M.A. Mazidi (2013). The microcontroller and embedded system 8051. Department of Computer Science and Information Engineering National Cheng Kung University, TAIWAN, second edirion.

9. Antonmio Augusto Gormi (1997). http://www.tms.org/pubs/journals/JOM/9704/Gorni/Gorni-9704.html.