The algorithms of technological processes of manufacture of sulfur

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Abstract: This paper discusses the developed automated control system to control the parameters of operation of the sensors wells produce sulfur and linked with the central system for the production of sulfur. And building the system and algorithm to determine scope of work within the range allowed by the standard and connect them with the warning system.
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Introduction

Designing control systems plays an important role in modern technological systems. Benefits from its improving management systems in the industry can be daunting. These include improving the quality of products, reducing energy consumption, minimizing the maximum cost, improve safety and reduce pollution.

Sulfur production is a complex system, where they interact with each other different items such as [1-4]:

1) Unit 1. Contain water tanks and provide the Company with water from the river;

2) Unit 2. Factory to produce process steam, hot water and compressed air; Administration (headquarters leadership, senior specialists);

3) Unit 3. The main unit of sulfur production (Wells sulfur);

4) Unit 4. Complex of factories (Processing plant sulfur);

An important stage of production is uninterrupted transportation of hot water, steam and compressed air through pipelines from unit-2 to unit-3 (production unit) else flow is uninterrupted transportation of sulfur from unit-3 to unit-4 [2].

Critical control parameters

Data on the production and alarms are used for operational management and partially accumulated for statistical calculations and analysis [5].

Much of this data can be collected in the form of deviations from the plan, the rules specify. Operational accounting data are also used for operational planning. The main way to improve the quality control is the automation of production control, in which the above problems are solved by means of computer technology.

The complexity of the process control determines the total flow of information, which can be detected in the process of careful study and analysis, the complexity of their processing and use of results. These flows define the number of sensors installed in the control system : the steam drum, deaerators, hot water temperature sensor, pressure sensors (exhaust pressure, the pressure in the drum, deaerator pressure, vapor pressure), flow sensors (air, steam, water) temperature sensors (temperature of the deaerator, the temperature in the steam drum of the boiler temperature, the temperature of steam, flue gas temperature) [6,7].

Frasch process

In the Frasch process, three concentric tubes are introduced into the sulfur deposit. Superheated water (165 °C, 2.5-3 MPa) is injected into the deposit via the outermost tube. Sulfur (115 °C) melts and flows into the middle tube. Water pressure alone is unable to force the sulfur into the surface due to the molten sulfur's greater density, so hot air is introduced via the innermost tube to froth the sulfur, making it less dense, and pushing it to the surface.[1]

The sulfur obtained can be very pure (99.5 - 99.8%). In this form, the Frasch process can be used for deposits 50–800 meters deep. 3-38 cubic meters of superheated water are required to produce every tone of sulfur, and the associated energy cost is significant [1]. A working demonstration model of the Frasch process suitable for the classroom has been described [8, 9].

Frasch method used to develop sulfur deposits in the Russia, USA, Mexico, Poland, and Iraq. This method is effective in mining of rich ores. On (Fig. 1) shows the process of production of sulfur by Frasch. There are a number of reasons, namely:

1) Depth of sulfur deposits on Tran is from 30 to 300 meters.
2) The low cost technology.
3) The existence of water near by the company.
4) Relatively pure sulfur at the first stage of production.

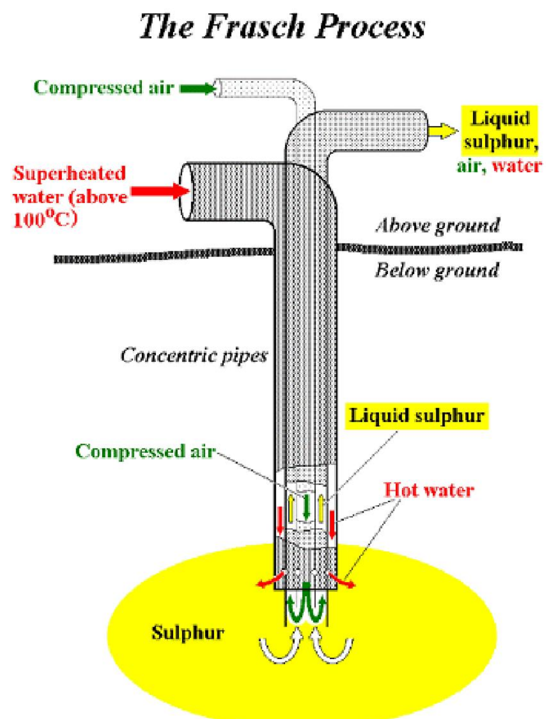

Fig.1. Production of sulfur by Frasch method

Development of algorithms for automated control instrumentation (sensors) on the production facility

In the industrial control system is preferable to use a differential equation of second order response time, since it reduces time and effort for analysis and system design. We prove that the rounding error is acceptable in most cases, the main form of the equation of the second order as follows.

$$G(s) = \frac{b}{s^2 + as + b}$$

$$a = 2\xi\omega_n \qquad b = \omega_n^2$$

Where (ξ) damping factor, (ωn) frequency, definition curve (response time) in Fig. 2, can be reflected in three special cases:

1) When ξ <0, the curve line is unstable;
2) When ξ = 0, a curve is stable;
3) When ξ> 0, critical damping curve

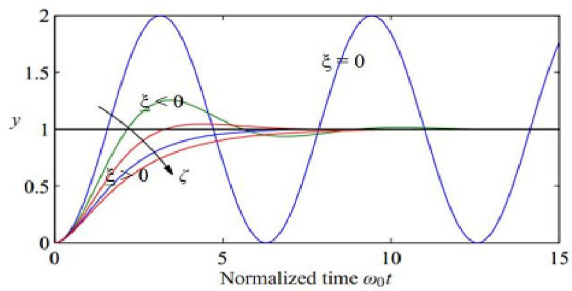

Fig. 2. Sample step response. The rise time, overshoot, setting time and steady-state value give the key performance properties of the signal

Production facility, which receives the specified components, is an area of high risk. To ensure safe and smooth operation of production necessary to implement an automated, remote control of all parameters of input and output components, such as temperature, pressure and flow in real time.

Technologically, piping components coming from the object, wells and tanks of production are equipped with various measuring devices (sensors) that at a given frequency send information about the current values of the parameters in the software and managing complex SCADA control point. Fig. 3 shows schematically the sensors are installed in pipelines that convey analog signal to the microcontroller. The microcontroller converts the analog signal into a digital signal and sends it directly to the local database operator - technician. At the same time, information is duplicated in the database server, where, if necessary, the management team may exercise intervention [10,11].

The algorithm of functioning

Basics of a PLC function are continual scanning of a program. The scanning process involves three basic steps (Fig.3):

Step 1: Testing input status. First the PLC checks each of its input with intention to see which one has status on or off. In other words it checks whether a switch or a sensor etc., is activated or not. The information that the processor thus obtains through this step is stored in memory in order to be used in the following steps.

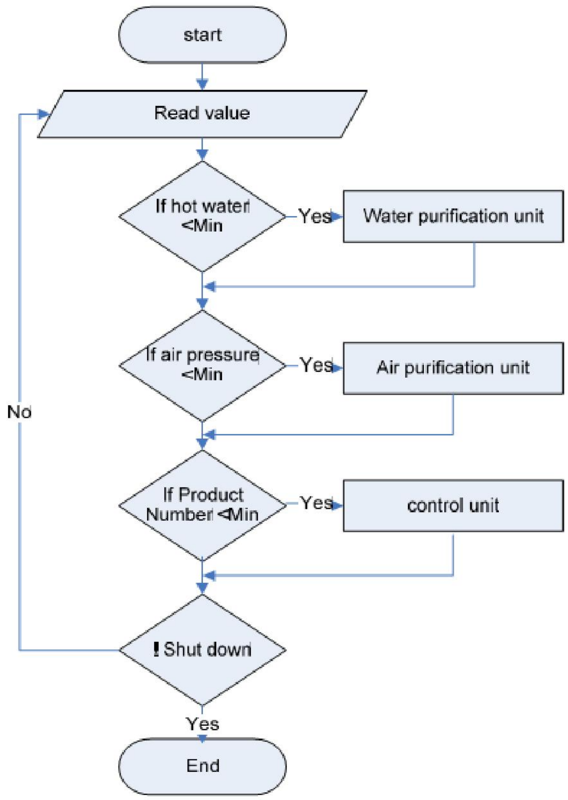

Fig. 3. Schema algorithm functioning Well-Sensors

Step 2: Programming execution. Here a PLC executes a program instruction by instruction based on the program and based on the status of the input has obtained in the preceding step, and appropriate action is taken. The action might be activation of certain outputs and the results can be put off and stored in memory to be retrieved later in the following steps.

Step 3: Checking and Correction of output status. Finally, a PLC checks up output signals and adjust it has needed. Changes are performed based on the input status that had been read during the first step and based on the result of the program execution in step two – following execution of step three PLC returns a beginning of the cycle and continually repeats these steps.

Scanning time = Time for performing step 1+ Time for performing step 2+ Time for performing step 3.

A comprehensive approach to automation of technological processes designing and monitoring in pipelines in the production of sulfur, consisting in the collection of data from all stages of the life cycle of pipelines their automated processing, updating the database, which allows to increase the objectivity and quality of the information analysis in the given subject matter. It is shown that the pipes are the arteries that connect the industrial objects. The algorithm of control sensors installed on pipelines of hot water and compressed air. Diagram of the algorithm is shown on figure 4.

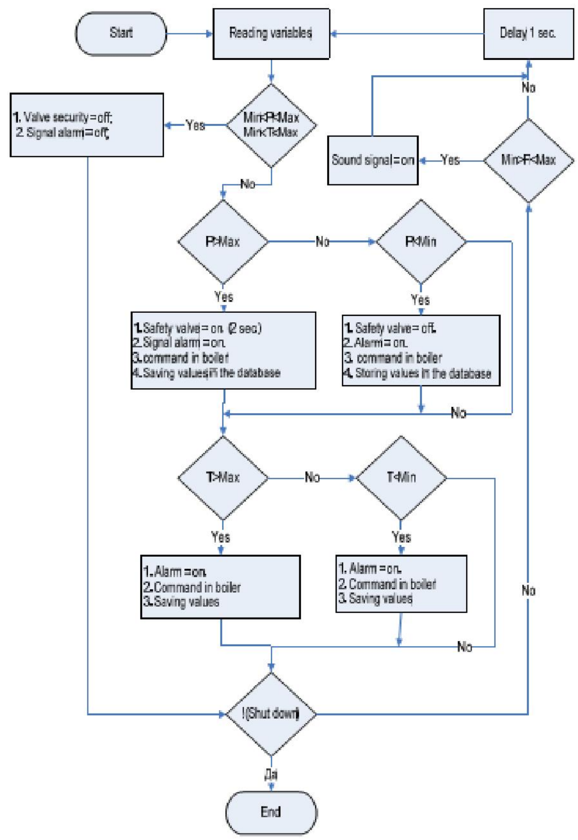

Fig. 4. Diagram of the algorithm of the compressed air sensors

Results

Designing control systems plays an important role in the control and monitoring of production sulfur, benefits from improving its management systems. This includes improving the quality of products, reducing energy consumption, minimizing the maximum cost, improve safety and reduce pollution.

Using computer technology appears in the most striking form when collecting and processing large amounts of information, implementing complex control laws.

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