The Energy Saving Control Syste of Pumping Unit

XingTang Zhao[a], Yuliang Wei [b], Guoteng Yuan [c], Huan Geng [d], Liang Li [d]

[1]Shandong University of Science and Technology, Qingdao 266590, China.

[a]1300751124@qq.com, [b]1004009592 @qq.com

Abstract

In recent years,with the increasingly severe energy problems, people pay more attention to pumping machine energy conservation. Beam pumping unit is an important facility for oil extraction, but also the main energy-consuming equipment,the system efficiency is very low. In order to save energy, research are begining to carry out in oil fileds. Under this condition, this paper has carried on the research to the pumping unit, developing a kind of pumping unit energy conservation control system. It is important to improve the operation efficiency of the beam pumping unit by reducing the production cost, saving energy and increasing oil production of low oil production wells through the star-to-angle bidirectional switching and intermitten pumping control system.

Keywords

Pumping unit, intelligent energy - saving system, Star – to - angle bidirectional switching, Interim -tent pumping control system.

1. Introduction

Beam pumping unit in the process of production, due to the boot load is bigger and the underground oil out of the oil is not stable, day and night change fluctuation is bigger, also the machine motor load is not stable, in order to can be normal production, must be equipped with big load of the state of the motor, this led to most of the time the drive motor of the pumping unit of the "big horse-drawn cart" running status, the motor efficiency and power factor significantly reduced.In addition, in the process of pumping unit to complete a pumping cycle, on the stroke and stroke under load imbalance, and the difference is big, although in order to improve the imbalance, pumping unit design with the purpose of the counterweight hung hammer. [1] However, due to the weight of the counterweight hammer is constant, and the well working conditions are not constant, and to adjust the weight is limited by field of many conditions, so the pumping unit is unlikely to be completely balanced.

The purpose of this paper is to improve the motor power, save energy, reduce consumption and reduce production cost.In recent years, the world's major oil field in the aspect of energy conservation and emissions reduction to reduce the production cost, invested a lot of technical strength and a huge research funding for research, all kinds of energy-saving equipment has been put into use, to a certain extent, a big success.

2. Control Scheme of Energy-Saving Pumping Unitworkpiece Analysis

Motor Y/Δ two-way switch device overall design as shown in figure 1, A/D transducer to accept and analyze the wellhead pressure sensor, current sensor, voltage sensor output signal, judge the downhole condition and underground situation is converted into A single chip microcomputer can identify discrete signal and control the electromagnetic relay is to choose the right means of open circuit, so as to realize motor Y/Δ two-way switch, and in this project, A/D sensor to downhole information input to

memory and display and control in abnormal situations trumpet sound alarm andcontrol motor to stop working.

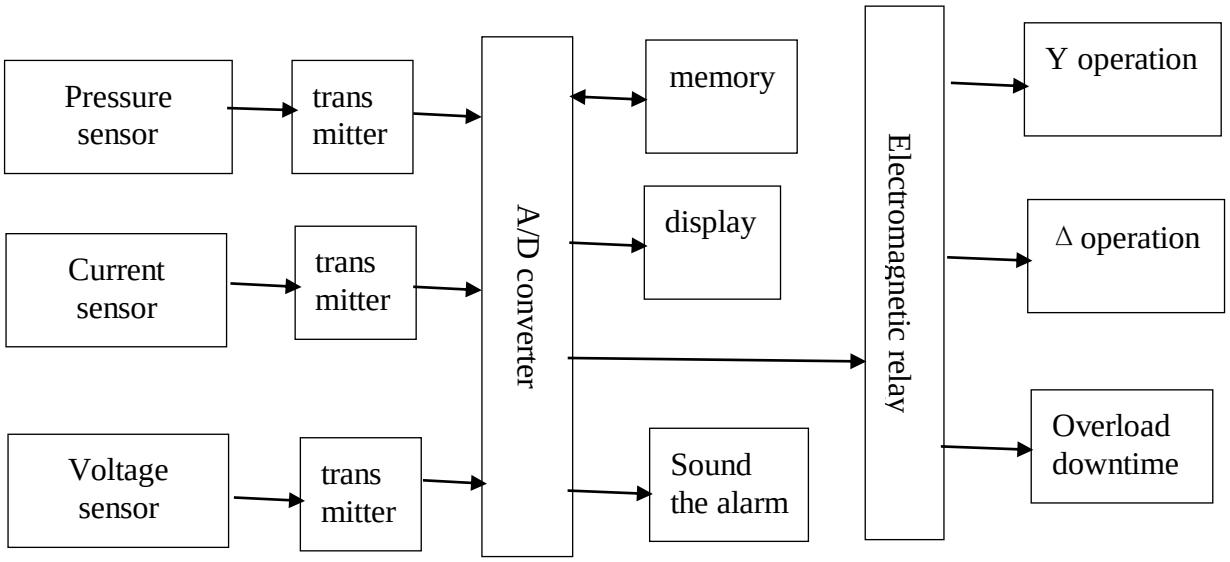

Fig 1. Master plan

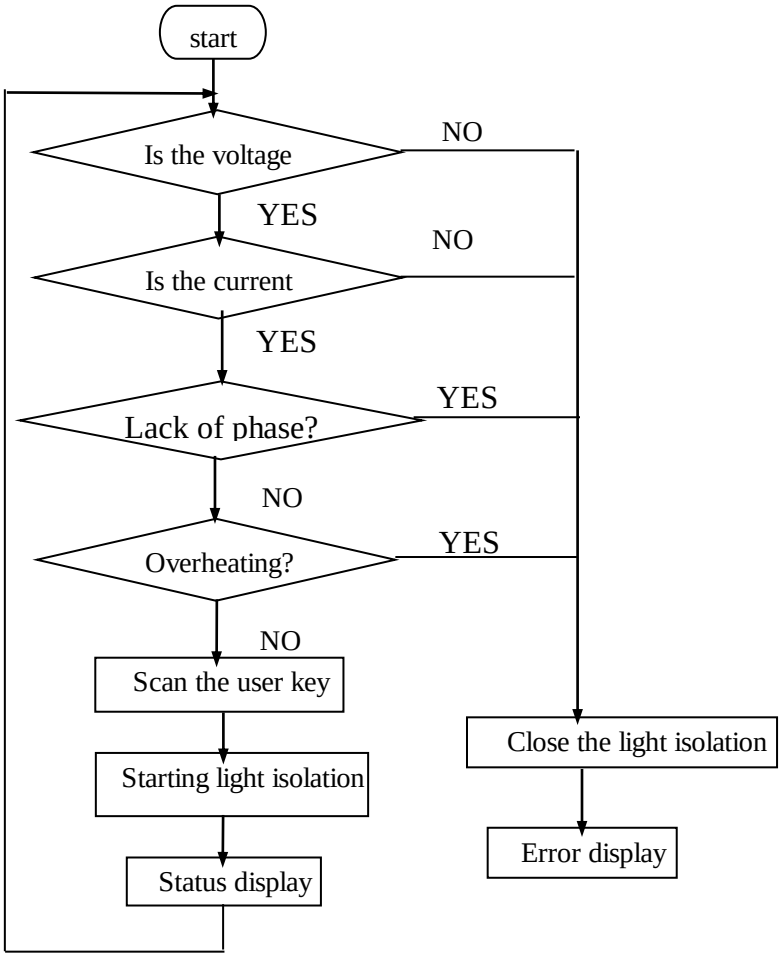

Fig 2. Block diagram of fault self - inspection procedure

This program is compiled by C51 language and designed as a module structure. The block diagram of fault self-inspection program is shown in figure 2.Visible, motor can not only detect the signal according to the normal operation of the high and low level control of the motor when the Y/Δ transformation, also can to control the step-down starting motor. [2]

Intelligent smoke control system between the total design scheme as shown in figure 3, current sensor, voltage sensor, power sensors, wellhead pressure sensors will receive the signals to the signal collection circuit, then regulate the signal to the A/D converter, A/D converter will be processed analog into A single chip microcomputer recognizable binary numeric representation of discrete signal, finally sent to AT89S51. [3]The switching time of the electromagnetic relay is controlled by the single-chip microcomputer according to the difference of received discrete signals, so as to realize intelligent inter-pumping of the pumping unit.

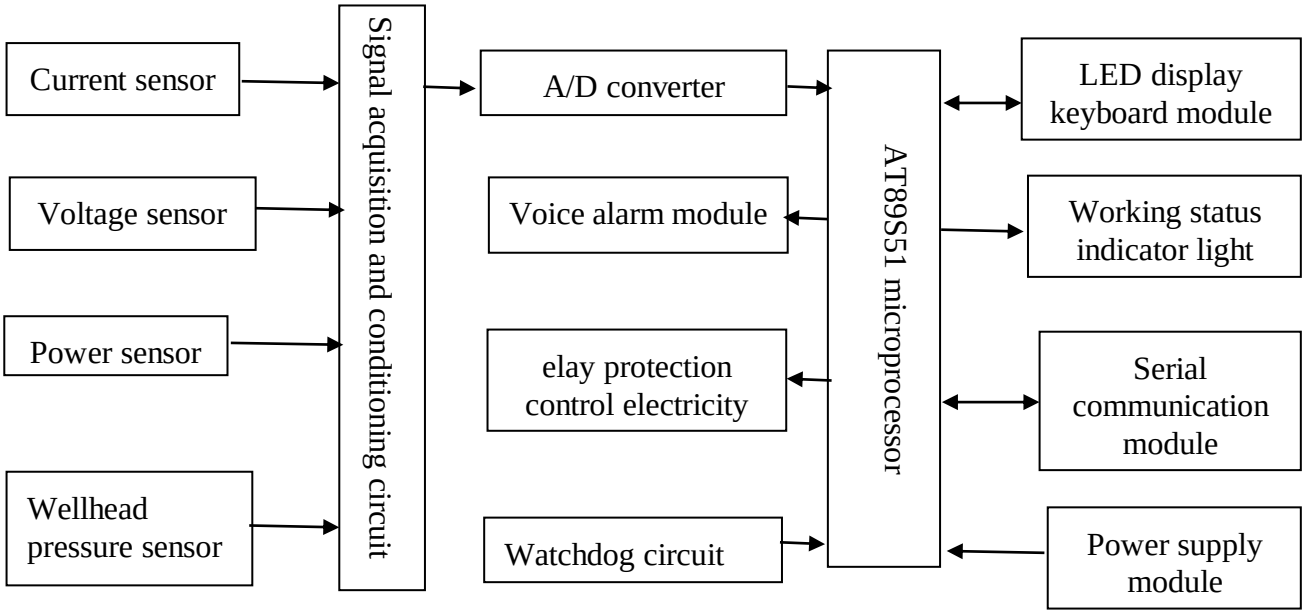

Fig 3. General design scheme of intelligent space extraction

2.1 The Design of the Positioning Scheme of the Workpiece

According to the structure of the box, process size, shape and position accuracy requirements, the workpiece positioning to be limited to six degrees of freedom. The positioning and clamping position of the workpiece has been specified in the process diagram, but in the formulation of positioning, clamping program, it should still be analyzed and studied, to determine the positioning of the benchmark is to meet the requirements of the workpiece position accuracy, fixture structure Can be achieved. [4]And finally determine the fixture positioning in accordance with the bottom of the Yangwei tail.

3. Analysis of Energy-Saving Pumping Unit System

3.1 Motor Δ/Y Two-Way Between the Switch and Intelligent Analysis of Smoke Control System

Motor Δ/Y two-way switch between intelligence and smoke control system can not only save resources, protect the function of motor, and the following technical characteristics:

(1)Starting when the automatic forced Δ way in order to satisfy the requirement with load starting.Due to the high power required when starting, the y-shaped connection cannot meet the starting requirements.

(2)After starting Δ, Y two-way switch to meet the requirements of light load and low energy consumption.After starting, when the motor is running normally, the power requirements of the motor are relatively small, and the y-shaped connection can meet the requirements.When overload operation, need high power, at this moment, through the single chip microcomputer automatic control, into Δ coupling.

(3)Two-way switching and inter-pump compound control can be carried out simultaneously.It can save resources and control production cost effectively through two-way switching and inter-pumping control. [5]

(4)Automatic overload protection can be provided.When the control system detects that the load is greater than the load of the motor, the stop signal will be sent to avoid equipment failure.

Motor Δ/Y two-way between the switch and intelligent in addition to smoke control system with automatic control function, also has conventional manual control function to meet the maintenance operation needs of the pumping unit and serve as the standby control scheme.When the pumping unit starts automatically in the state of inter-pumping stop, an alarm bell can be issued in advance to remind the field personnel to pay attention. The system is equipped with sensor detection and compulsory control functions to record the time of failure so as to find out the cause.The low cost design of the whole machine facilitates the oil field to obtain economic benefits as soon as possible.

3.2 Motor Δ/Y Two-Way Between the Switch and Intelligent Control System Field Test Result

Record in the second production plant in hebei bazhou 105 Wells, ten of the beam pumping unit in the application of Y/Δ bidirectional switch and intelligent smoke control system between before and after normal working day, pumping oil production and test the system power consumption.

Through the comparison of oil production and electricity consumption before and after application, the following conclusions can be drawn:

(1) application of Y/Δ bidirectional switch and intelligent between before and after the smoke control system, daily oil production gap is not big, therefore, the system will not affect oil field pumping scheme. [6]

(2) application of Y/Δ two-way switch between intelligence and smoke control system after running time significantly reduced compared to that before application, significantly reduce the power consumption, can effectively reduce the cost of pumping, avoid the useless waste of resources. [7]

4. Conclusion

As people pay more and more attention to energy conservation, oil field, as a large energy consumer, is bound to receive attention from people all over the world. Ordinary beam pumping unit and oil field application can't meet the requirements of energy conservation and emissions reduction, to design the motor Y/Δ two-way switch. [8]The practice has proved that motor Y/Δ bidirectional switch is pumping unit is a kind of effective energy saving technology, the system design is reasonable, the reliability, stability is good. [9]

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