HOISTING INSTALLATION CONTROL AND MONITORING SYSTEM BASED ON MAIN FUNCTIONAL PARAMETERS

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Abstract: The automation of the multi-rope hoisting devices requires, in a first stage, the working out of the automatic control system of the main work parameters, and then, on the basis of their interpretation, the working out of the reaction loop: computer - hoisting installation. The singular and the global interpreter of the dimensions corresponding to the main work parameters at the local of the computer through a suitable soft, the comparing of the admissible maximum or minimum values, allows the command of the hoisting installation through the computer. The paper contributes to the minimizing of the human factor intervention in the work of the hoisting installation leading to the increasing the safety in exploitation and the command through a numerical computer leads to the decreasing of the dynamic stresses at the mechanical parts are subjected during the exploitation, what means a growth of the transport capacity.

Keywords: monitoring, automatic control, parameters

1. AUTOMATIZATION OF HOISTING DEVICES

In order to perform automation of a hoisting device, the following conditions must to being fulfilled:

- The start of the hoisting device in automatic regime only when the hoisting vessels are located in the loading discharging ramps;
- Switching from manual command on automatic command only with brakes on and vessels in loading/discharging ramps, and vice-versa in any position of the vessels;
- Selection of the movement sense of the device when the vessels are located at the loading-discharging ramps;
- Possibility to stop the device by two independent systems;

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- Manual command for maintenance and unexpected situations;
- Switching on manual command after the safety brake is actuated;
- Realization of the tachogram and safety curves at the overspending of the device;
- Stop of the device by the action of safety brakes at overspending with 15% without the operator's action;
- The check of the integrity of cinematic elements and the working brake by acting the safety brake in case of any trouble;
- Check of the opened position of working brake at the beginning of the hoisting cycle;
- The stop of the device t the end of the hoisting cycle insuring the appropriate position of vessels for loading/discharging;
- Protection against overheigthing;
- Protection against overload and short circuit of the electrical network by acting the safety brake;
- Insuring a low speed start of the vessels from the loading ramps, limitation of the acceleration under 1 m/s^2, reduction of the speed at 0,6 ± 0,3 m/s at the proximity of the ramps;
- Survey of the position of vessels in the shaft;
- Possibility to use electrical braking by electrical drive in case of deep shafts;
- Stability of the operating (regime) speed independently at the main drive charge;
- Possibility of remote control by buttons from the loading/discharging ramps and from the vessel (compartment for personnel) in case of personnel transportation;
- Survey of the parameters of the compressed air system from the braking system, lubricating system and other auxiliary devices;
- Switching on the safety brake at any trouble in the device's normal operation and switching off only in manual regime and after the elimination of the trouble;
- The existence of two independent systems for the survey and limitation of the maximal speed;
- Protection in case of an important wear of the braking pieces;
- Protection against reversing torque of the electric drive;
- Protection against the overheating of the electric drive wires and bearings;
- Signalization of the troubles with the indication of the involved safety device;
- Signalization of the cause of the interdiction of the restarting of hoisting device in case of trouble;
- Signalization and record of the position of the brake of the state of switchers, of the presence of tension, of the position of vessels and record of the tachogram;
- Measure of the production hoisted by weighting;
- Non-destructive survey of ropes.

For the automatization of the mining hoisting devices the main problem is the automatic performing of the speed diagram of the main electric drive (the tachogram) insuring all the protections required by the production process or in case of troubles. In the process of operating the hoisting device the deviation of the speed from the nominal value can appear at the variation of the charge at the end of the cycle, at improper action of the braking system during the manual command or due to the perturbations which can occur in the functioning of the electrical network of the device.

2. REALIZATION OF THE MONITORING AND CONTROL SYSTEM

Monitoring the mean parameters of a hoisting device using a computer requires the conception of an informatics system which allow the continuous acquisition of the values of the items under survey, their interpretation and analysis, and on the basis of comparison with allowed limits the transmission of commands towards the hoisting device in order to correct the parameters which the values are out of the prescribed range, and if it is not possible to command the stop of the device.

In the figure.1 the block scheme of the proposed informatics system is presented taking into account the above-mentioned conditions.

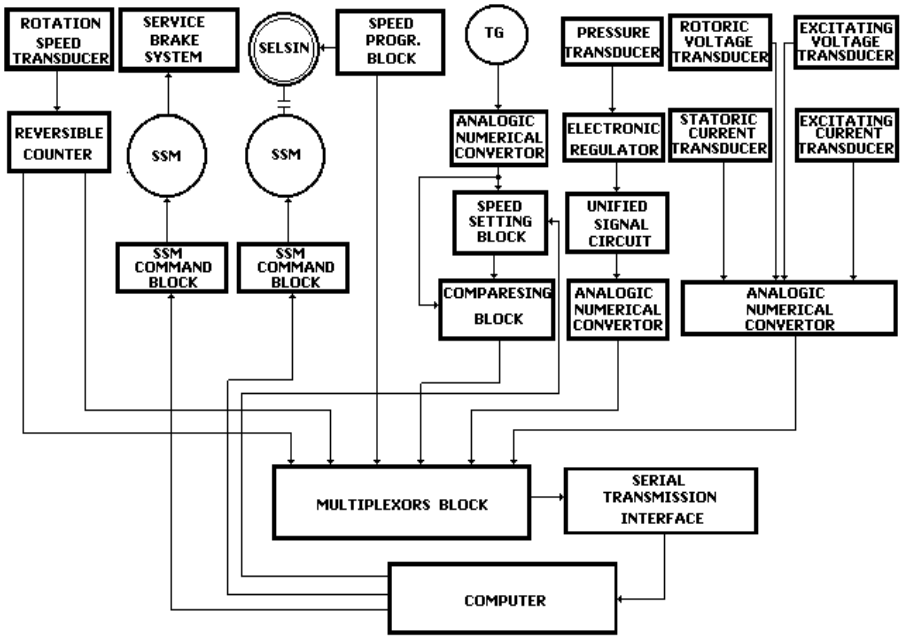

Fig.1. Block scheme of the informatics system

It can be seen that the data acquisition is realized automatically, the primary surveyed items being both electrical and non-electrical ones. This imposes the utilization in the monitoring process of transducers.

In the frame of the presented informatics system we can distinguish two

components:

One which perform the data acquisition related to the working parameters of the hoisting device, and the feed-back realized by commands acting on the working brake, safety brake and speed programming-prescribing block.

The acquired data are multiplexed and transferred by a parallel/serial interface towards the serial port RS 232 of a computer. At a reading command, all the multiplexed bytes are read. The feedback commands are sent by the parallel port.

3. INTERPRETATION OF RESULTS

The computer has the role to interpret the corresponding values of the surveyed items. After each reading of a block of informations the values issued from the interpretation process are compared with the admissible values of each item. If all the read parameters are in the allowed range, a new block of values are read. In opposite case, if one of the monitorized parameters is out of the allowed range, then the computer send commands by the parallel interface. The result of the monitoring process is shown in the fig.2, which is a screen copy of the monitoring process.

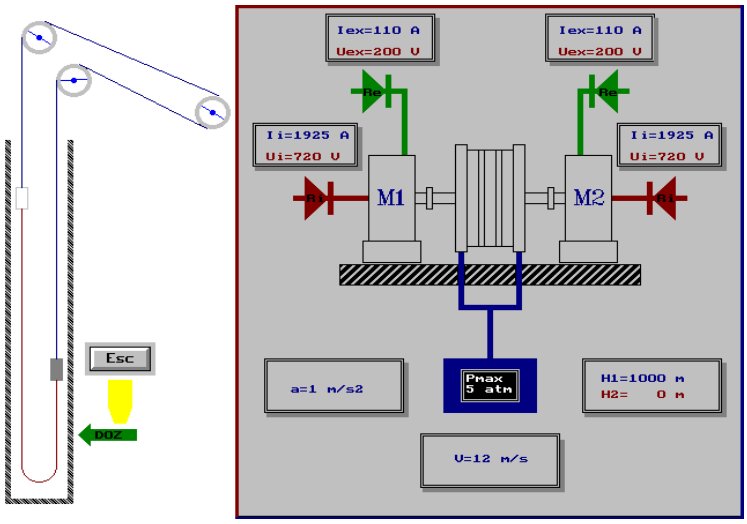

Fig.2. The output of the control process

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