THE PRESENTATION OF RESULTS OBTAINED THROUGH THE IMPLEMENTATION OF A PROGRAMMED CONTROL SYSTEM FOR THE TRANSPORTATION OF RAW MATERIALS IN A FNC

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ABSTRACT

One of the main activities in an FNC is that of transporting the raw materials from the deposits to the processing installations. To increase the productivity of the work and the safety of the entire activity, it is considered good practice to have an automated control over the workflow.

By using an electronic montage of own design, a set of experiments was executed, facilitating the analysis of a set of magnetic rotation and proximity sensors, usable in the construction of an automated control conveyor belt from a FNC. This article presents some of the results of our research activities to automatically monitor transport in a FNC.

INTRODUCTION

The raw materials used in the method of operation are carried by means of transport such as auto-trucks and wagons, and when they arrive inside the factory they are stored in special spaces.

From the reception deposits, the raw materials are carried through a transportation chain of redler horizontal conveyors to the vertical elevator, and from here these materials are delivered to the supply containers. Here are to be found the devices and mechanisms that conduct raw materials towards the installations for the production of combined fodder (figure 1).

a b

Figure 1: Conveyor belt in a FNC
a - horizontal conveyor
b - vertical elevator

The redler band is an electromechanic horizontal conveyor made up of a closed chain of links, which is put into a horizontal movement provided by an electric motor and a speed reduction unit (geared motor).

The elevator is a vertical transport device of raw materials, made of two vertical pipings with rectangular cross-section, through which is moving a rubber conveyor belt on which are mounted cups of transport at equal intervals. With these vertical conveyors the raw material is elevated from the level of the initial deposits reaching up heigths of about 20-22 m.

MATERIAL AND METHOD

At the realization of the electric assembly used to study the possibilities of automatic control of the transport of a FNC there were magnetic sensors used which allow the conversion of a non-electric size unit (in this case it represents the distance from a metallic body , actually the rotation of a metallic body) in a electric unit (tension).

The functioning of the sensors is based on the principle regarding the modification of the field lines created by reels that are charged by an oscillator of high frequency. As a metallic body approaches a sensor, the magnetic field lines modify themselves determining the end of the oscillations and thus they determine the modification of the magnetic circuit' induction. The demodulation electrical circuit (figure 2) gets this impulse and it commutes the electrical signal to the "on" state (figure 3), which is amplified by the amplifying circuit. Then this electrical signal is sent to sensor's charge, which can be an accelerating relay or a stopping relay or a relay which only counts impulses and it is a part of the automatic command circuit.

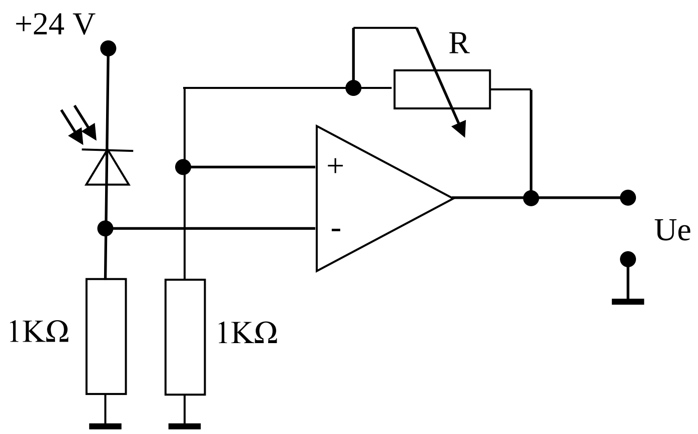

Figure 2: Electrical circuit used to obtain the electrical unit of evacuation (Ue)

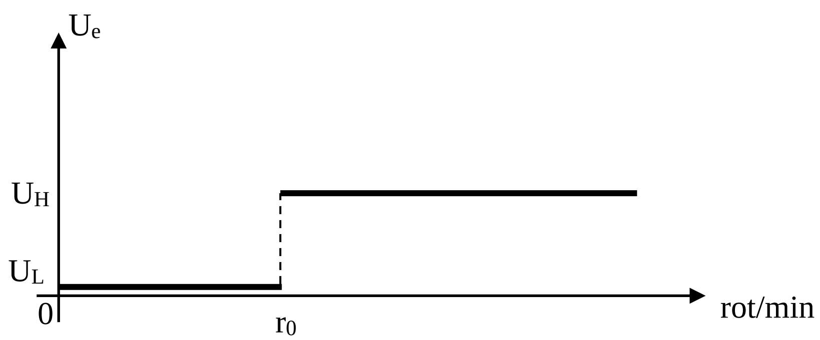

Figure 3: Electrical exit (tension) of a magnetic sensor

In order to observe the rotative speed of the roll corresponding to the transportation band we realized an automatic control device made up of the following parts:

1) magnetic sensor to register the XSA-V11373 rotation speed
2) metallic bar (150-120 mm) individually fixed on axes of the stretching roll
3) an intermediary relay with a NCcontact and a NO contact
4) a time-delay relay with a NO contact and a NC contact
5) 220V-24V rectifier

The proximity magnetic sensor has a 24-36Vcc charge and it functions as an impulse generator each time a metallic object approaches it. The electrical scheme for the charge of this magnetic sensor is presented in figure 4.

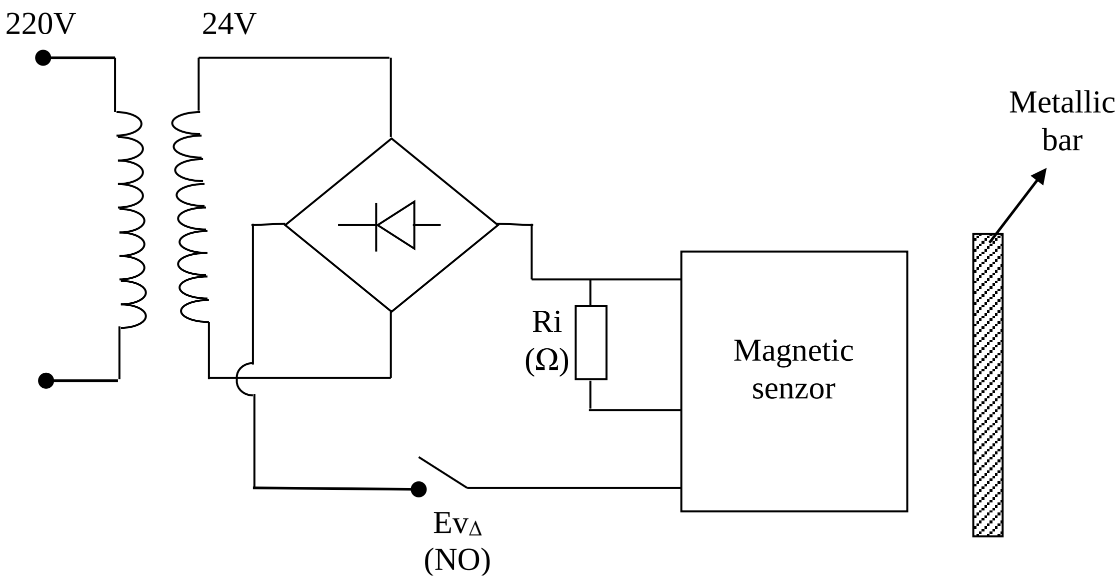

Figure 4: The electric power scheme of the XSA-V11373 magnetic sensor

The sensor's exit is a XSA-V11373 relay type and thus it keeps charged the intermediary relay Ri for as long as the metallic band gradually passes consistently at the same time, through his right. This means that the answer is "1" logical (24 V) when a metallic band passes by the sensor and this passing keeps a relatively constant rhythm. If the metallic band spins at a speed that is different from the one initially requested, then the IFR200 relay of the sensor interrupts the energization of the intermediary relay. Thus the answer this time begins "0" logical (0V).

THE OBTAINED RESULTS

The personal design of our assembly used for this experiment (figure 5) consists of the following elements:

- 220Vca-24Vcc rectifier
- an engine of the air blower with 80W/1500 rotations per minute
- a XSA-V11373 sensor to register the rotation made by TELEMECANIQUE
- a IG5798 proximity sensor made by IFMA ELECTRONICS
- 2 intermediary relays
- flashlamps at 24 V
- a variable voltage regulator to modify the engine's speed

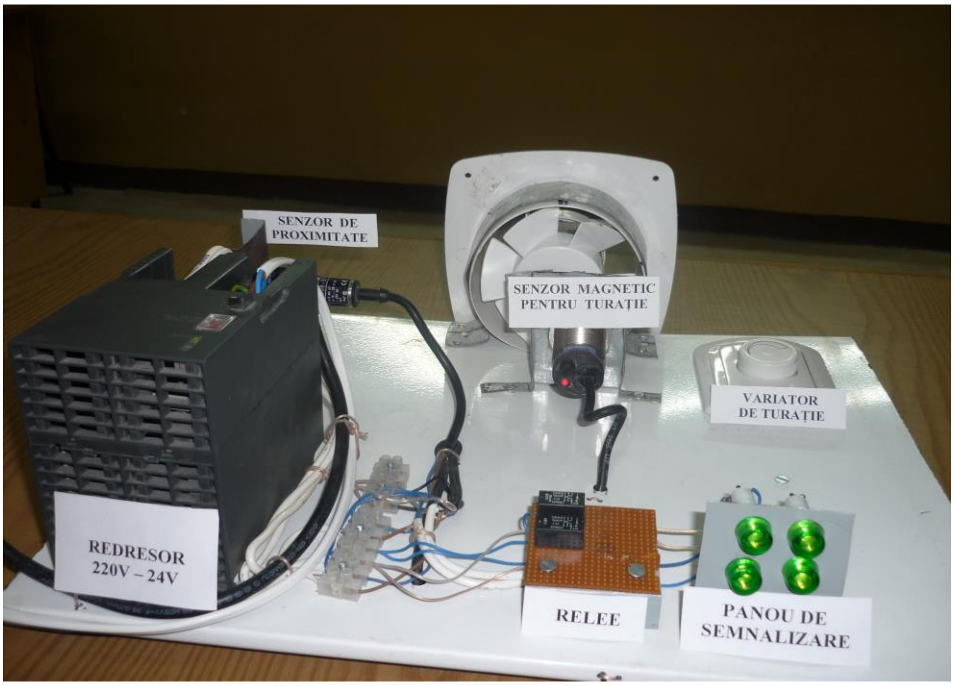

Figure 5: The electrical assembly used to study the function of the 2 metallic sensors

In order to test the speed rotation sensor, the measurements were carried out with the EBRO DT-2236 (figure 6) electrical tachometer which registered the value of the rotation specific to the metallic band attached to the base of a rotor resembling the cylinder of the trasportation bands.

Figure 6: The usage of the EBRO DT-2236 electrical tachometer to determine the rotation of the metallic band attached to the cylinder

At the experimental testing of the proximity magnetic sensor we used a metallic object, which was gradually closed to the sensor (figure 7), in order to measure the best distance between the sensor and the metallic object such as to trigger the normal functioning of the circuit and also was measured the time response in the case of the proximity sensor used.

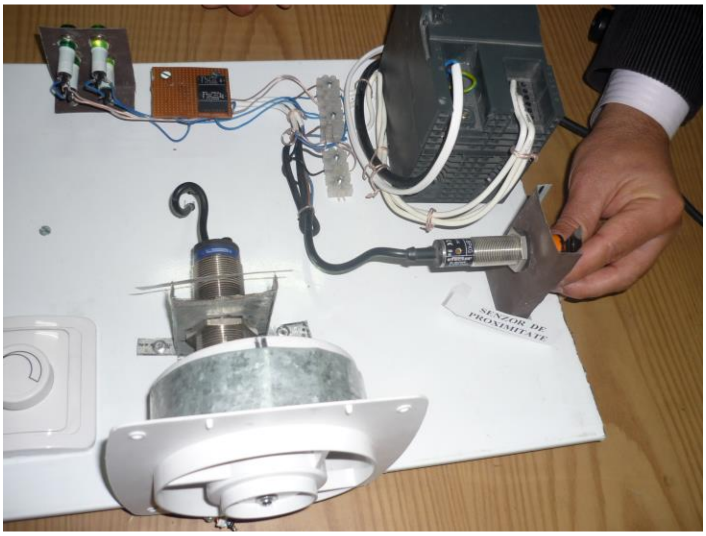

Figure 7: The establishment of the IG5798 proximity magnetic sensor's function

At the end of the experimental analyses that we carried on, a series of results concerning the function of the two magnetic sensors were obtained.

For the proximity magnetic sensor we conducted several experiments in order to determine the best distance between it and a metallic object, in such a way that this sensor should detect the metallic object and should transmit a signal towards the impulse counting circuit or that of the initiation of the route limitation device, and these results are to be found in table 1.

Table 1

The distances needed for the accurate functioning of the proximity sensor

Distance [cm]	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2	2,1	2,2
Sensor response	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	not

As for the magnetic sensor destinated to measure the rotation, we estimated the distance at which this sensor detects the moving metallic object, and the results are written in table 2.

Table 2

The determination of the specific characteristics for the motion detector sensor

Distance [cm]	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2	2,1	2,2	2,3	2,4
Sensor response	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	not
Response time	2s	2s	3s	3s	3s	4s	4s	4s	4s	4s	5s	5s	5s	5s	6s	6s	-

DISCUSSIONS

The research regarding the functioning of the sensors involved in the automatic control of the transportation band chain in a FNC was carried out with an electronical assembly designed by the authors of this paper. Thus we tried to stimulate specific essential aspects of the above mentioned process.

Through the deployment of these electrical automatic control devices specific to the kinematics of these transportation trains, one can find a series of advantages:

- a significant decrease of the interruption for the time allotted to the working flux
- an increase in the safety degree in the use of the transporting installations of raw materials
- the almost entire elimination of the raw materials lost on their way from the reception stations to the combined fodder production installations
- the increase of the labor productivity through the assurance of an automatic control for the start-up and the stoppings of the train transportation
- the production process improvement and as an implicit consequence the increase of the quantity of the end products.

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