STUDIES AND TECHNICAL EXPERIMENTS CONCERNING THE DESIGN OF AUTOMATED LOAD MONITORING SYSTEM FOR A VERTICAL ELEVATOR

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Abstarct: *By integrating our country into European Union structures there were created from entering the premises of the Romanian products on the European and even worldwide market, fact which led to a need to increase competitiveness of producing compound feed factories, to gain and retain markets in this area. Thus, the central objective of any compound feed factory is to obtain some recipes as varied as possible, continuously improving the quality of final products made and services offered to customers in order to maintain an upward trend in the activity profile. This article studies the possibilities of implementation of some monitoring and control equipment automated of the activities of transport which is taking place in a CNF, through the design of some devices based on rotating magnetic sensors which are transmitting signals to stop the transporter train in the case of detecting a change in the normal rhythm of operation.*

Keywords: *equipment, automation, sensors, compound feed, competitiveness*

INTRODUCTION

For optimal operation in a CNF must consider the automatic flow control technology, which includes among others and continuous monitoring of the loading conveyor train.

This transport train is composed of several conveyor belts of horizontal carrier tape and vertical lift, which is to climb raw material in storage or waiting bunkers.

The critical point of train transport underlies the elevator down, because there, in the event of failure, can collect large quantities of raw materials, which can block the normal operation of the conveyors and can even lead to breaking the transmission bands, which both lead to loss of time, but financial.

These things should be avoided if we are to increase labor productivity and therefore this paper proposes a device allowing continuous monitoring of the frequency of rotation of the drum to lift the engine and if this rotation is not in the optimum învadrează then automatically determines turn off the conveyor tapes.

MATERIAL AND METHODS

DESIGN AUTOMATED LOAD MONITORING SYSTEM FOR A VERTICAL ELEVATOR

The elevator is a mechanical system is used in vertical transport of granular materials such as cereals, for deposit in specially built bunkers.

A vertical elevator consists of a rubber conveyor belt, with fabric insert, which are mounted cups transport amount by which the product (cereals or their derivatives). Conveyor belt is driven by an electric motor with an output of 11 kW through a mechanical gearbox.

Based on the way to the particular construction and elevators, it is known that rubberized fabric conveyor belt is as easy and also is possible that this band is tensioned via a stretcher located at the elevator (lift base).

In operation, the conveyor is fully loaded (the cups are filled to a depth of 45m), the band stretches because of weight and reel in those circumstances stretcher not have the same speed with the train drum band. This stretching of the band lead to friction cups elevator walls, followed by blocking or breaking the conveyor belt, which is undesirable.

Thus, during the vertical transport of materials needed to produce fodder concentrates, due to certain factors such as machine wear, stretching the rubber band, tape tensioner inertia, dropping product carried one bucket and tray routing, can lock in lift operation. Blocking means that the conveyor belt moving at low speed and the drum causes friction drive, which leads to breaking them. This is undesirable because it involves repairing the conveyor belt for more intervention and may also cause loss of product.

Failure elevator leads to stagnation in the production process as breaking or damage the rubber conveyor belt need repair work very difficult and causes an average over 24 hours of intervention. Cost us a band up to tens of thousands of dollars, and its installation takes over 14 hours.

Therefore it is necessary to find a solution to protect the system of vertical transmission and immediate stop the transport train in case of operating outside the optimum parameters.

For this scope, to avoid such unpleasant situations, it is necessary to install a monitoring system that turns the drum speed of the conveyor belt tensioner.

To achieve such an automatic control device fot the transport train can use the following parts:

1) magnetic sensor for monitoring speed type IFR200
2) metal slide (120-150mm) mounted tension drum axle solitary
3) an intermediate relay NC contact and one NO contact
4) time relay with one NO contact and one NC contact
5) an 220V-24V rectifier

IFR200 product by IFM from Germany is a magnetic proximity sensor which has the power CC24-36V and operates as a pulse generator whenever it passes right through a metal object. Power supply scheme of the magnetic sensor is shown in Figure 1.

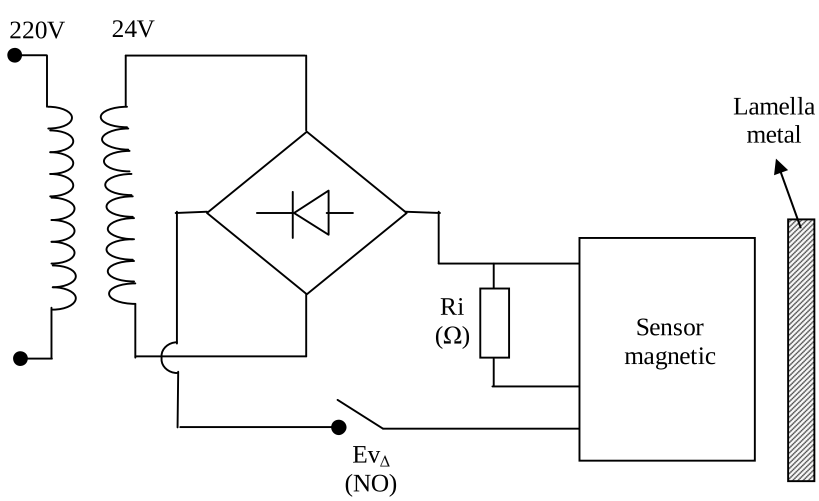
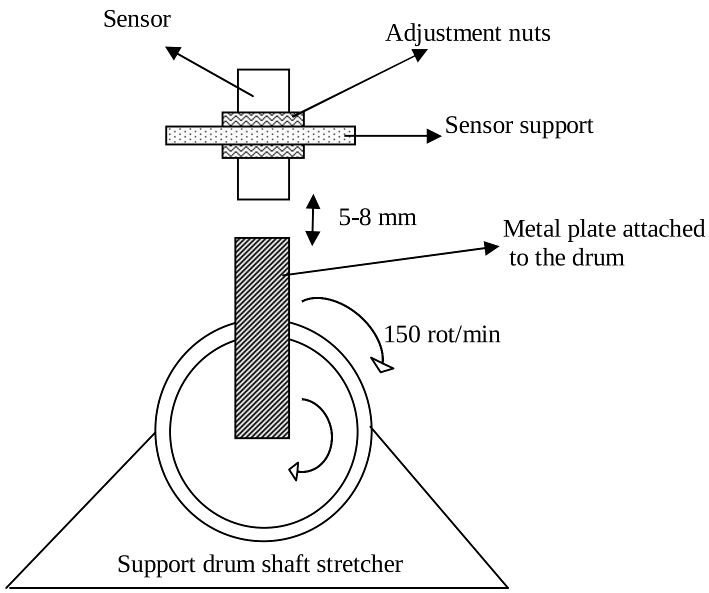
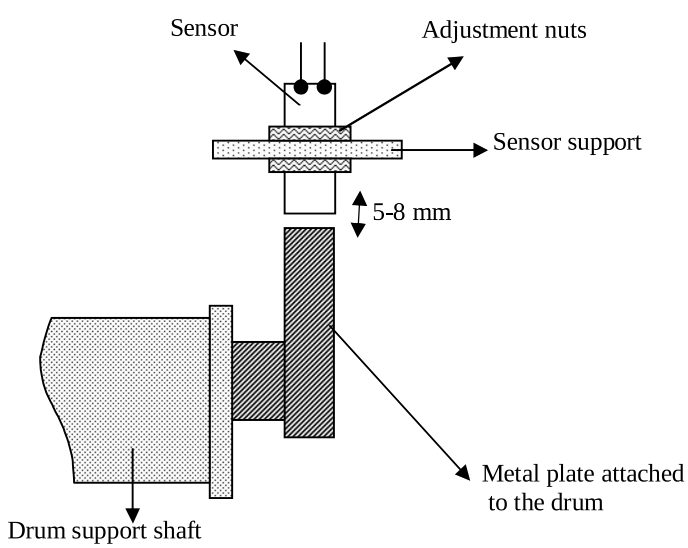


Fig. 1 - Power supply schemeMagnetic Sensor IFR200

IFR200 sensor is also equipped with an internal memory that stores a period of 3-4 seconds each time passing through the metal plate right (given that running a metal plate rotating as it is mounted on the drum engine). Working sensor threshold is chosen depending on the speed of the drum catalog stretcher. In our case it is chosen a range of 120-180 rpm, considering that the normal operation of the sensor is 150rot/min.



a) Front View



b) Side view

Fig. 2 - Scheme to speed up magnetic sensorpulse counting

Figure 2 is presented (two views) method of attaching the metal plate on the engine rotating drum so that the right slide to pass through the magnetic sensor is mounted on a special support above the drum.

IFR200 sensor output relay is powered and maintained as long as Ri intermediate relay metal plate passes steadily at the same time, by right. That answer is "1" logical (24 V) when the sensor passes right through a metal tab mounted on the motor rotor and the transfer maintains a constant frequency.

If the metal plate so attached revolves with a speed different from the previously saved, then relay sensor reacts IFR200 intermediate stop relay, that answer at this time will become "0" logic (0V).

To this end we considered that the sensor output relay is:

- "0" logic (0V) when the frequency drops below 30s for 150 pulses / min
- 1 logic (24 V) when the frequency is close to 150 pulses / min and maintained around this value.

Should mention that this magnetic sensor is fitted with a trimmer for sensitivity adjustment pragrului (reaction time).

Monophase scheme for star-delta start is the classic, the component that has been introduced in addition an intermediate relay terminals connected to the output of magnetic speed sensor.

Intermediate relay contact NO (normally open) is connected in series with contactor coil control line that feeds the engine drive belt elevator, aiming to cut power to the contactor coil EvL line in case of abnormal operation of the elevator. There is also a time relay (TR2) which normally closed (NC) contact is connected in parallel with normally open (NO) relay of intermediate countries.

Timers mounted in parallel with NO contact NC contact of relay intermediate and act after the triangle connect the drive motor (3-9s) and maintain powered lift contactor coil (EV) powered engine is star-connection triangle, while the engine is driving increasing speed until the engine is operating within the rated speed. At first, to start the installation, use a star-shaped connection, and after a period of more than 9s while you connect the triangle engine timers and does not supply contactor coil is maintained through the relay contact NO intermediate.

Thus, pressing the power P supplied Ev_L contactor coil voltage, which keeps contact auxliar normally open (NO) and fuel type RT_1 time relay normally closed (NC), which by default disconnect time Ev_Y contactor coil, which is making the start contactor in the motor phase star connection and connect through RT_1's that type is normally open (NO) Ev_Δ contactor coil and connection is done from this point of engine operation phase triangle (figure 3).

When starting up to make the connection star-delta (Y-Δ), timers Rt_2 is to maintain contactor coil fed Ev_L and two contactors Ev_Y and Ev_Δ. After the preset time (greater than during the realization of the connection star-delta Y-Δ) power contactor coil is by contact normally open (NO) of intermediate relay which is powered by the output logical "1" magnetic sensor.

If overload decreases elevator speed of the conveyor belt tensioning drum and the sensor will notify the swingarm and logical "0", disconnecting the intermediate relay Ri and stopping power coils Ev_L, Ev_Δ and Ev_Y. Thus, at low speed drum tension, IFR200 relay works by stopping the supply voltage via the relay and contactor power cut this line and thus the lift drive motor stops. Proceed to check the mechanical elevator and removed it because of incorrect operation.

Thus it protects the lift conveyor belt very well. System gave excellent results in tests and test will be installed such devices on existing carriers inside the company.

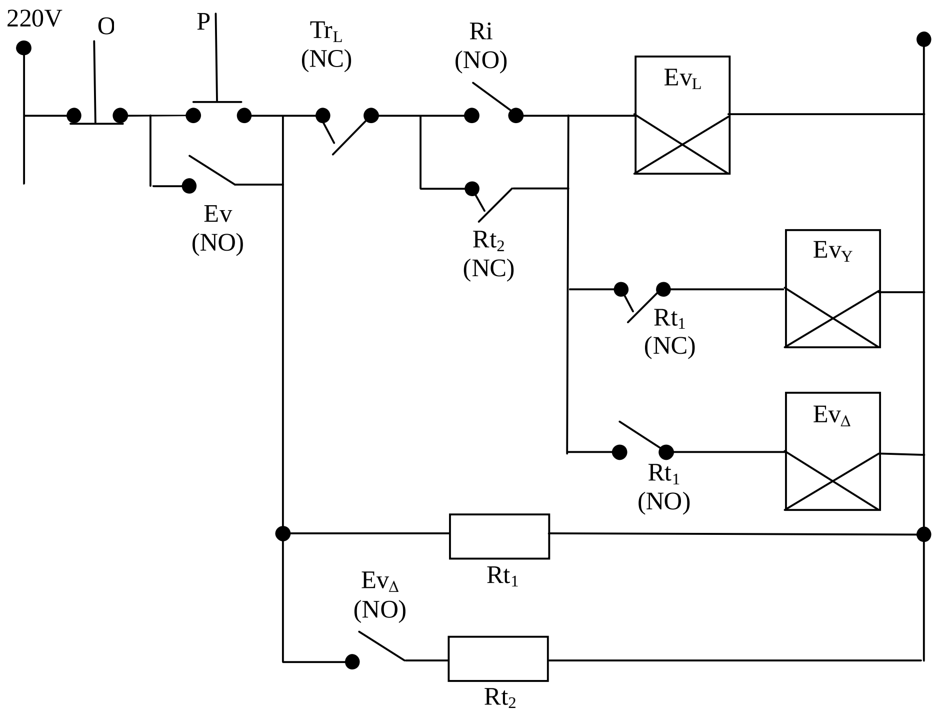


Fig. 3 - Scheme monophase power coilselevator contactors type star-delta (Y-Δ)

Mounting these magnetic and their interconnection scheme of protection and power control of electric motors, conveyor belt leading to protection, to extend the use of rubber bands. Also speaking time made for release and replacement conveyor belt lifts was reduced from 18-24 hours (in case of intervention) to a maximum of one hour per week.

RESULTS AND DISCUSSIONS

While performing analysis, we have seen that major technical problems that may occur quite often in a CNF during the technological flow are related to transport the majority of raw materials, product transport and ground transport of the finished product to bunkers delivery problems consisting of blocking carriers, the elevators or worm, all of which are due to metal or other bodies that may occur accidentally in mass products.

To avoid problems of transportation of raw materials from silos FNC's considered to achieve electric schemes to control automated conveyer belts, and if operating loss realiezeze immediately to stop them from first conveyor located silo near where you take raw materials, intermediate carrier and then finally lift off vertically.

The order to stop the train of carriers is determined provided that occur quantities of raw materials to gather in places merge conveyor thus does not block the normal functioning of these bands.

IFR200 magnetic sensor enables automatic train control of carriers due to its features construction (Table 1).

Table 1

IFR200

Operating voltage [V]	10...36 DC
Current rating [mA]	100
Short-circuit protection	pulsed
Reverse polarity protection	yes
Overload protection	yes
Voltage drop [V]	< 2.5
Leakage current [mA]	< 0.1
Current consumption [mA]	< 20
Pressure rating [bar]	100 **)
Operating distance [mm]	0...3.25
Hysteresis [% of Sr]	1...20
Switching frequency [Hz]	2
Ambient temperature [°C]	0...85
Protection	IP 67, III

CONCLUSIONS

Increased work performance in a CNF is determined by assuming responsibilities in terms of quality machinery used, their reliability and efficiency during the technological flow. Lately there is a increasing tendency to control very precisely to each activity and individual equipment so as to eliminate as much as possible any problem that may occur in plants producing various recipes for compound feed.

The objective of this report is to study the possibilities of implementation of automated monitoring and control modules of the activities taking place in a CNF by building the carriers control devices based on magnetic rotation.

To avoid problems of transportation of raw materials from silos FNC's considered to achieve electric schemes to control automated conveyer belts, and if operating loss realiezeze immediately to stop them from first conveyor located silo near where you take raw materials, intermediate carrier and then finally lift off vertically. The order to stop the train of carriers is determined provided that occur quantities of raw materials to gather in places merge conveyor thus does not block the normal functioning of these bands.

In this paper intends to implement an experimental study tracking how automated operation of the conveyor train by mounting FNC motion sensors designed to continuously monitor the transport process from the plant's silo CNF preparation recipes for mixed fodder. Thus, magnetic speed sensor is mounted on vertical lift drum acting engine will detect any possible change of rhythm is normal in these situations will give the signal to discontinue operation of the train carriers in the order mentioned above.

Using these automated and computerized control modules allow greater reliability of the FNC's facilities, increased safety during operation and a significant increase significantly the efficiency of work, resulting in significant savings for beneficiaries of money and time.

Also, by applying these technologies and computerized automated control of the activities conducted during the technological flow to improve technical and economic parameters of the processes of storage, transportation of plant facilities silos, grinding grain and for various recipes mixed fodder, thereby aligning these sites FNC performance requirements and compliance of existing environmental protection in Europe and worldwide.

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