THE AUTOMATIC TRACKING OF DEPOSITING THE TILES FROM THE PRODUCTION LINE

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Abstract: It is created a methodology of designing a tracking system for the transport band towards the deposit for the tiles that were taken from the production line. The computer management of the tracking process of the tiles production offers a solution that is in conformity with the qualitative requirements that need to be fulfilled by the building materials in the context of the current competition that exists on the building materials market. The operation of depositing the tiles in optimal and safe conditions is very important because it has impact on the tiles' quality. The main purpose of a computer management system is to allow the active control on the tiles' production environment, thus increasing the efficiency and profitability of the enterprise. The technical-economic effects that are obtained by automating the process of depositing the tiles in racks are: an increased efficiency of the tools and installations, a reduced time of waiting because of accidental stops, a higher quality of the products and less wasted products.

Moreover, working with a database ensures a rigorous evidence of the production and therefore of the consumptions too.

Key words: storing, programming, construction materials

1. DESCRIPTION OF THE PROCESS OF PRODUCING THE TILES

The tiles are obtained from cement mortar, which is prepared in a bunker, and are formed on metallic molds, through a continuous pressing of the cement mortar. Afterwards, they are individually cut with a metallic cutter. A conveyor, which has a ventilator that eliminates the excess of mortar from the tiles, takes them with a higher speed than that of the forming band (in order to distance them with 1-2 centimeters) and transports them to the rack chargers.

This technological stage ensures a thermal treatment of the new tiles, in order to obtain a resistance of the cement mortar, which will allow the wrapping of the tiles a

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few hours after the molding process ends, depending on the duration of the thermal treatment and on the temperature from the treatment room.

The tiles that are obtained are loaded using a loading conveyor. When the tile reaches the charger, a photocell commands the actuation of the loading chain with one step, thus the tile being lifted one step above the loading conveyor, allowing the following tile to be taken. This happens until the charger is filled with a certain number of tiles and after that the loading chain is positioned to push the tiles in rack. The operation of loading the rack consists in moving the tiles in the rack using the pusher from each charger.

After the tiles from the charger are placed in rack, the series of racks moves one step to the evacuation end, using the transversal conveyor and an empty rack is positioned in front of the chargers, for a new charge.

The thermal treatment of the tiles has the purpose of increasing the mechanical resistance of the tiles for the removal of the formwork.

After the cycle of thermal treatment is over, the racks full of tiles that are taken by the evacuation conveyor are transported to the racks' rotary and taken over by the its transporter chain.

The activity that removes the palletization represents the operation through which the tiles that were thermally treated are separated from the metallic molds, with the purpose of packing the final products and recirculating the metallic molds in the production process. In the technological process of tile production, various technical unconformities appear and if these cannot be prevented the result will be some unsatisfactory products and a sorting operation will be necessary.

The sorting operation consists in removing the tiles that are unsatisfactory from the transport conveyor and directing them towards the installation that packs the products that look unsatisfactory. These are classified in either partially or totally discarded tiles.

The partially discarded tiles are products that:
- have uneven color;
- present more than two breaches at the edges and at the corners;
- present breaches with 10 or more millimeters length at the edges and at the corners;
- have foreign objects in their mass.

The totally discarded tiles are products that:
- have fissures and cracks;
- have segregations;
- have fractures.

The operation of packing the final products is done by a group of automatic machines and installations, with a high degree of technicality.

The operation of storing the final products must be considered a very important one because the tiles are to be delivered a few days after the fabrication, according to the instructions of the technological process. Therefore, the storing process is done in a manner that allows the access to each batch of tiles.

2. DESCRIPTION OF THE DATABASE

An ORACLE database is used for designing, interrogating and modifying the data from the tables of the managing program.

The database's structure is presented in figure 1 and is composed of the following tables:

Rastel- with the fields: *rastel_id, numar_rastel_id, data* and *ora.* These values are read from the database, from the table *numar_rastel* and are written in the database.

Numar_rastel- with the fields: *numar_rastel_id, data, ora, valoare.* These values are permanent, are changed when the database is archived and are written in the *table rastel.*

Pachet- with the fields: *pachet_id, rastel_id, data, ora,* values that are read by the program for saving them in the database.

Configurare- with the fields: *configurare_id, bucati_tigla, bucati_pachet,* values that are read by the application for establishing the characteristics of the tiles packages.

The values of the fields from the tables *numar_rastel* and *package*, necessary for writing in the database, in the table *Rastel*, are read from the database.

Pachet	Numar_rastel	Rastel	Configurare
Pachet_id Data Ora Valoare	Numar_rastel_id Data Ora Valoare	Rastel_id Numar_rastel_id Data Ora	Configurare_id Bucati_tigla Bucati_pachet

Fig. 1. The structure of the database

The connection with the database is established at the beginning of the technological process and remains stable throughout the entire process, conveying data that is used in making decisions regarding the parameters that need to be followed.

All the parameters that are read from the installation are sent as information to an acquisition board which is attached to a computer. This information is processed and saved in the tables from the Oracle database. The decisions that are made after comparing the values that are read from the installation with those that are read from the database are afterwards transformed into decisions of implementation or decisions of returning the counter to zero, for changing the rack section, for maintain the number of tiles and for saving the variables of the technological process in the database.

3. THE LOGICAL OPERATING SCHEME FOR THE
SYSTEM OF STORING THE TILES

To ensure the right development of the storing process, which ensures an optimal regime, a technological process must be implemented for the command of advancing and grouping the tiles, according to figure 2. The installation for storing the tiles has sensors with which the tiles and the racks that transmit the parameters in which the technological process must fit are counted. Basically, the number of tiles and racks that enter the deposit are counted.

Figure 2 presents the logical functioning scheme for the storing system.
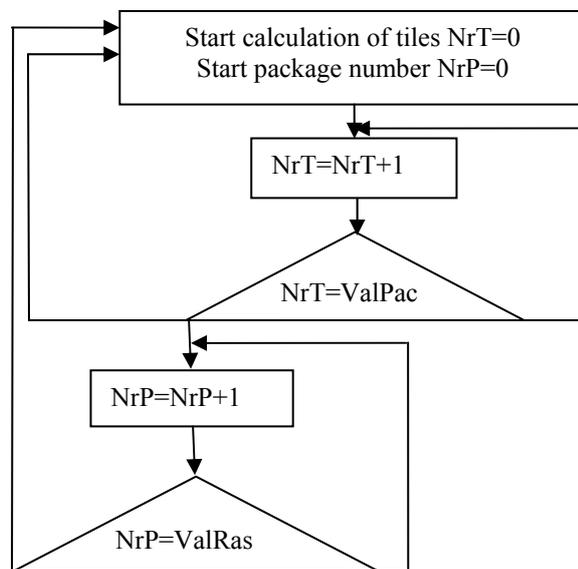

Fig. 2. The logical scheme of the storing system

Almost all industrial processes are characterized by having many inputs that generate many outputs, with strong interactions between variables.

The variables that are read from the installation *I1, I2, ..., In* are taken from the photoelectrical cells and are associated with the variables of the program *$I1, $I2, ..., $In*, which are compared in every moment with the exact value of the number of tiles from a package and afterwards the packages are counted and the values are written in the database. The values *E1, E2, ..., En* are transmitted throughout the storing process and are actually execution elements from the process of storing the tiles, like it is presented in figure 3.
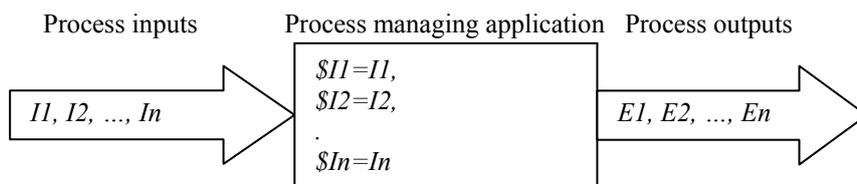

Fig. 3. The scheme of the transmission of execution decisions

When storing the tiles, the inputs of the process are impulses that are generated by passing each tile or each package in front of a photoelectrical cell that transmits a signal to the managing program. Depending on that signal, a decision is made. It is decided if a new package has to be created or if another one has to be filled with tiles. Thus, the principle of counting the tiles from a package in the language Visual Basic is the following:

// I1 is the input that is read from the installation from the transducer that is used for making a package and is sent to the variable *$I1*. This variable is compared with the constant value, read from the database, from the table Pachet.
$I1=I1
$I2=I2
.

.
$Formare_pachet = 0
If $I1 <= Valoare
$I1 = $I1 + 1
Endif
$Formare_pachet = 1
//The variable *$Formare_pachet* takes the value *1* after the loop for counting the tiles from a package. This value is transmitted to the technological storing process for finishing forming a package and preparing another one.

The program for managing the technological process has a module that is used for ensuring the connection with the database and for writing the values in the database in the tables: *pachet, numar_rastel, rastel* and *configurare.*
After executing a cycle of forming the number of packages that are to be deposited in a rack, the data that is specific to the technological process is written in the database, in the tables: *Pachet, Numar_rastel* and *Rastel.* The data will be afterwards consulted for making reports that are specific to consumptions and to normalized consumptions. The functioning diagram is presented in figure 4.
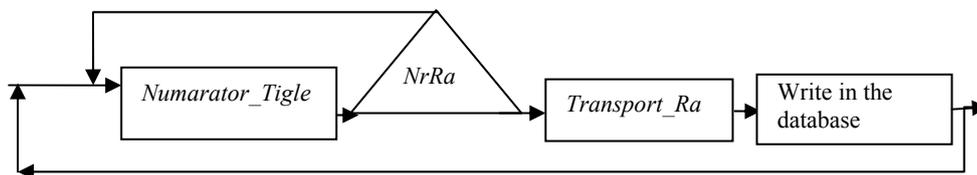

Fig. 4. The system's functioning diagram:
Numarator_Tigle – the current number of tiles is incremented in the variable tigla, from the process managing program; *NrRa* – vVariable from the process managing program, which is compared with *Numarator_Tigle*;
Transport_Ra – variable which is incremented with 1 at each rack transport.

The result of the comparison between the values that were read from the installation and the values from the table *configurare* are sent in the installation, to the elements that execute commands, for transporting the tiles or the packages of tiles. These values are written in the database, in the tables: *pachet, numar_rastel* and *rastel*.

4. THE ACCESS TO THE DATABASE AND THE DIALOGUE
WITH THE DATABASE

The functions that are needed for the connection with the database mysql (or Oracle, as it is similar) are declared using the instructions from the programming language Visual Basic, which are presented below. The connection remains open throughout the execution of the program. The connection is made with the *username root* and the *password root.*

```
Public ConexiuneaDB As ADODB.Connection
Public Function ConectareLaBazaDeDate() As Boolean
ConectareLaBazaDeDate = False
On Error GoTo EroareInitDataBase
Set ConexiuneaDB = New ADODB.Connection
ConexiuneaDB.CursorLocation = adUseClient
NumaratorTigle=0
NrRa=0
Transport_Ra=0

ConexiuneaDB.ConnectionString = _
"DRIVER={MySQL ODBC 3.51 Driver}; " & _
"SERVER=" & CFG.IPserverDB & "; " & _
"DATABASE=mysql; " & _
"UID=root; " & _
"PASSWORD=root; "
```

In case some errors appear, they are reported in the following way:
```
On Error GoTo EroareConectareLaBazaDeDate
'MsgBox ConexiuneaDB.ConnectionString
ConexiuneaDB.Open
s = _
"Server='" & CFG.IPserverDB & "'" & vbCrLf & _
"UserName='" & CFG_UserName & "'" & vbCrLf & _
"Conectare reusita."

Call AppendFisierLOG(s)
ConectareLaBazaDeDate = True
```

```
Exit Function
'

EroareConectareLaBazaDeDate:
EroareInitDataBase:
End Function
```

The connection with the address of the database is done with the instruction:
If CFG.IPserverDB <> "localhost" And CFG.IPserverDB <> "127.0.0.1" Then
Exit Sub
'

Creating the database TIGLA with the instructions:
Call ExecutaComandaSQL("CREATE DATABASE IF NOT EXISTS TIGLA ;")

' Creating the table pachet in the database TIGLA

```
s = "CREATE TABLE IF NOT EXISTS    tigla.pachet  (" & _
" PACHET_ID        VARCHAR(" & LG_TIMP & ") NULL, " & _
" DATA         VARCHAR(" & LG_DATA & ") NOT NULL, " & _
" ORA           VARCHAR(" & LG_RASTEL & ") NULL, " & _
" VALOARE            VARCHAR(" & LG_VALOARE & ") NULL, " & _

s = s & "); "
'MsgBox s
Call ExecutaComandaSQL(s)
```

All these commands are written in the language of managing the process of storing the tiles. The access to the database can be done through a web browser too.

5. CONCLUSIONS

The achievement of some optimal values of the technical-economic indicators for storing the tiles from the production line in the maturation warehouse highly depends on the accuracy with which the prescribed technological regime is followed.
When perturbations of the working parameters happen and the temperature from the production line, as well as the speed with which the tiles move on the production line or on the storing line exceed the limits that are allowed, the production decreases and the quality of the tiles is lower. Therefore, a fast notification of the violation of the working parameters is necessary and the effects of this stage of the technological process need to be annihilated, in order to prevent future problems that might appear in the next stages of the technological process.
Computer management must ensure the objectives that were decided at the production management level. The process is equivalent to the technologies,

equipment, machines and manpower that are used during the production.

Socially, the system that was created ensures: *the modification of the character of the work, the elimination of routine and tiredness, the increase of work security, better working conditions by keeping human operators away from vibrations, steam and high temperatures.* Computers process a large amount of data and information that are received from the installation with high precision and in accordance with the parameters from the technological process management program, ensuring the flexibility of the storing process depending on the packing system, number of tiles, dimensions etc.

The operation of the automatic management system is dictated by a series of algorithms that process the information under time, costs and other restrictions. The technological process of storing the tiles, managed by the computer, decreases the number of wasted products, increases the quality of the packets of tiles, and thus increases the quality of individual tiles.

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