

non sta a guardare: sono già diverse le aziende che hanno prodotto delle applicazioni ad-hoc per questi nuovi modelli, dedicate alla consultazione ed alla vendita dei propri prodotti dalle stesse.

Il settore eCommerce, nonostante ormai non sia più di per sé una novità, vive un periodo assolutamente positivo ed il mercato mostra che ci sono dei sensibili margini di miglioramento. La nascita di nuovi attori e la scomparsa di altri è talmente frequente che difficilmente suscita stupore (cosa che nel mondo reale è tutt'altro che così) ed il settore risulta ancora possedere un discreto grado di mutamento e di evoluzione, specialmente in un'ottica di nuovi media coinvolti e di tecniche di eMarketing.

Ad oggi, non sarebbe realistico immaginare il mondo del commercio in uno scenario privo di internet e della vendita online, e sarà certamente interessante vedere quali sorprese ed ulteriori rivoluzioni arriveranno a portare nuove innovazioni in questo mercato.

UDC 681.51

A CONTROL SYSTEM FOR GRANULATED MIXED FODDERS' PRODUCTION

Irene Kukharengo

(The Don State Technical University, Rostov-on-Don, Russia)

One of the modern mechanical engineering pressing problems is automation of agricultural products' processing. This article reads an automatic system developed to control the process of mixed foddors' granulation at the KOVSH Flour Mill in Rostov-on-Don.

A pellet-press, Fig. 1, is the core process equipment used for mixed foddors' production. The press is designed to produce pellets from whole grains by pressing them at high-temperature. Operation of the pellet-press can be described as follows. The raw material is fed onto a screw driven by an induction motor whose speed is governed by a frequency converter.

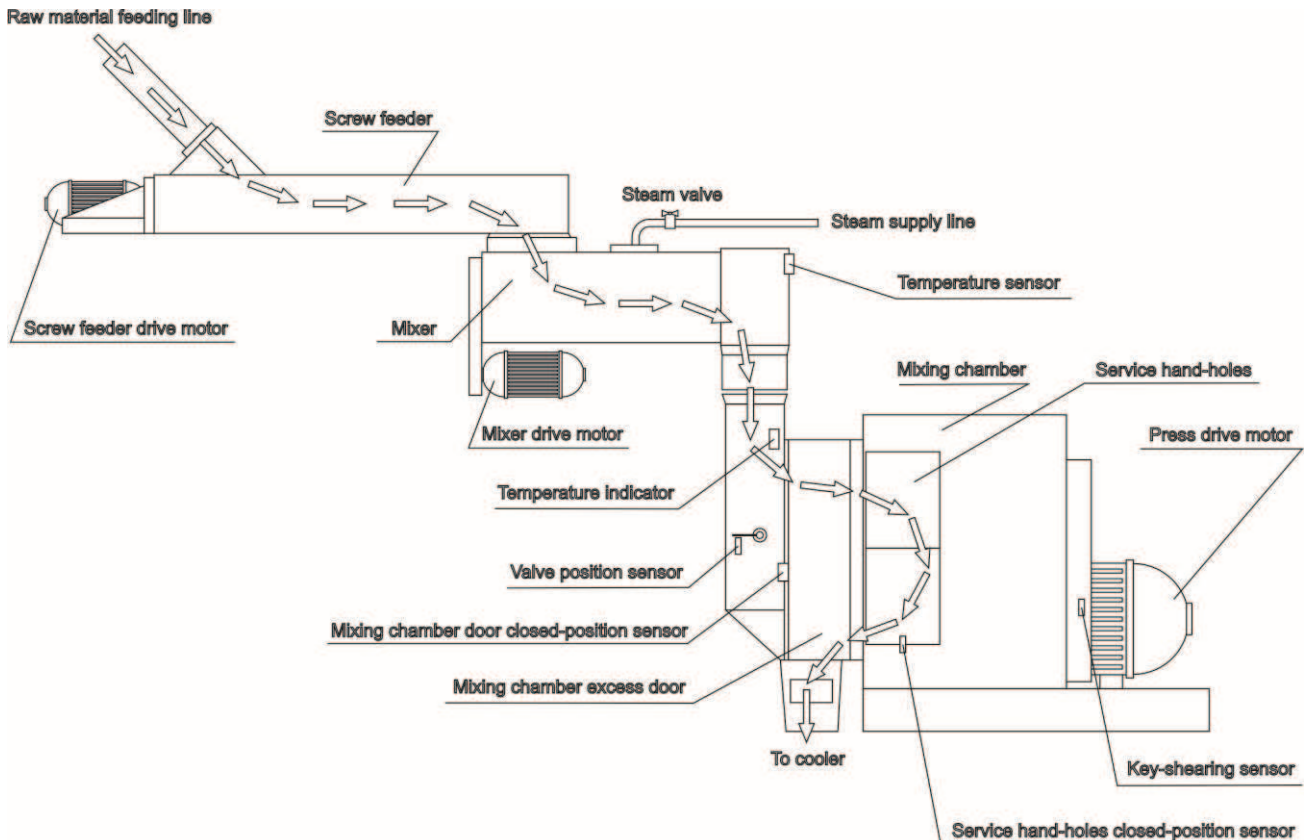


Fig. 1 – Schematic view of a pellet-press

It allows to control an amount of the raw material supplied to the mixer's chamber to be there humidified and heated to the temperature specified by steam valve operation. Then the heated mix is fed to the press where it is forced through rotating former block's apertures by two rollers. As a result, solid pellets are made which, at the final production phase, are supplied to a cooler.

The induction motors used for the press and mixer are not speed-controlled and used at the rated speed. Loads on the press depend both upon quantity, as well as physical and mechanical properties of raw material used, which happen to very much differ. This can cause overloading of the press, which occurs often enough. To prevent any overload-caused emergency cases, there is a special-purpose system using various interlocking sensors intended to de-energize all units of the press to interrupt its operation.

The mixed fodders' production process can be characterized by several parameters, with temperature and humidity of raw material fed into the press being key ones. Pressing of heated grain mix is a considerably delayed action process associated with some problems. Firstly, physical properties of the mix are dependant upon its temperature. This dependence is nonlinear and of the hard-to-predict manner. This may cause fluctuation of the system's parameters during its operation. Secondly, the quality control of pellets does not include anything more than their just being inspected by operator. With possible variations in the raw material composition considered, the automatic mode of the system's operation was designed on the basis of several rules, each applicable for a particular case or range of variations. This approach also allows manual control of the steam-to-raw material ratio. Thirdly, quantity of raw material fed into the press is measured by the motor current and therefore recorded with a substantial delay. This may cause fluctuations in values of the system's parameters during the press start-ups and affect quality of pellets produced over the start-up time.

The aim of making the pellet-press controlled automatically is a possibility of minimal-delay control of raw material temperature and quantity fed into the pressing area. This causes stability of granulating process and results in proper quality of the product. To solve this problem, an algorithm for granulation automatic control system was developed, as shown in Fig.2. The algorithm consists of two circuits, both functioning jointly, with one intended for temperature and the other – for current control. This algorithm consists of a core and some auxiliary modules, with each being responsible for control of a particular parameter of the granulation process. They are modules of current stabilization, of steam supply regulation, and the one to govern rates of the raw material supply.

There are three conditions to be fulfilled prior to beginning the operation procedures. They are as follows: all external equipment and blocking sensors shall be in an active state, with a confirmation signal of the granulation process start-up received. Thereafter a permission to switch on the equipment is issued, and further program functioning is limited to stabilization of such parameters as temperature and current. Current stabilization is made by fast changing the rate of raw material supply as dictated by the signal from a current sensor. During the process of operation, the module of current stabilization generates signals used to handle the raw material feeding rate. The temperature stabilization is performed by maintaining size of the steam valve's flow orifice, as dictated by a signal from the heatproof sensor in the mixing chamber.

The core component part of the automatic control system hardware is a MELSEC FX programmed logic controller manufactured by the *Mitsubishi* company. This decision was based on an idea that programmed logic controllers, unlike personal computers and microcontrollers, are intended for industrial use and are equipped with a number of expansion modules which allow to build an automatic control system to be easily tailored to meet any specific targets.

Coupling of the pellet-press with the granulation automatic control system allowed to:

- control operating modes to match with quantity and quality of the raw material to be processed;
- avoid occurrence of emergency operational conditions and thereby provide conditions for reliable operation of the press during its rated lifetime;
- decrease the probability of emergencies and associated dead time occurrence.

Testing of the system in the field conditions proved its high operational liability. It also revealed increase in the press capacity by more than 7 percent.

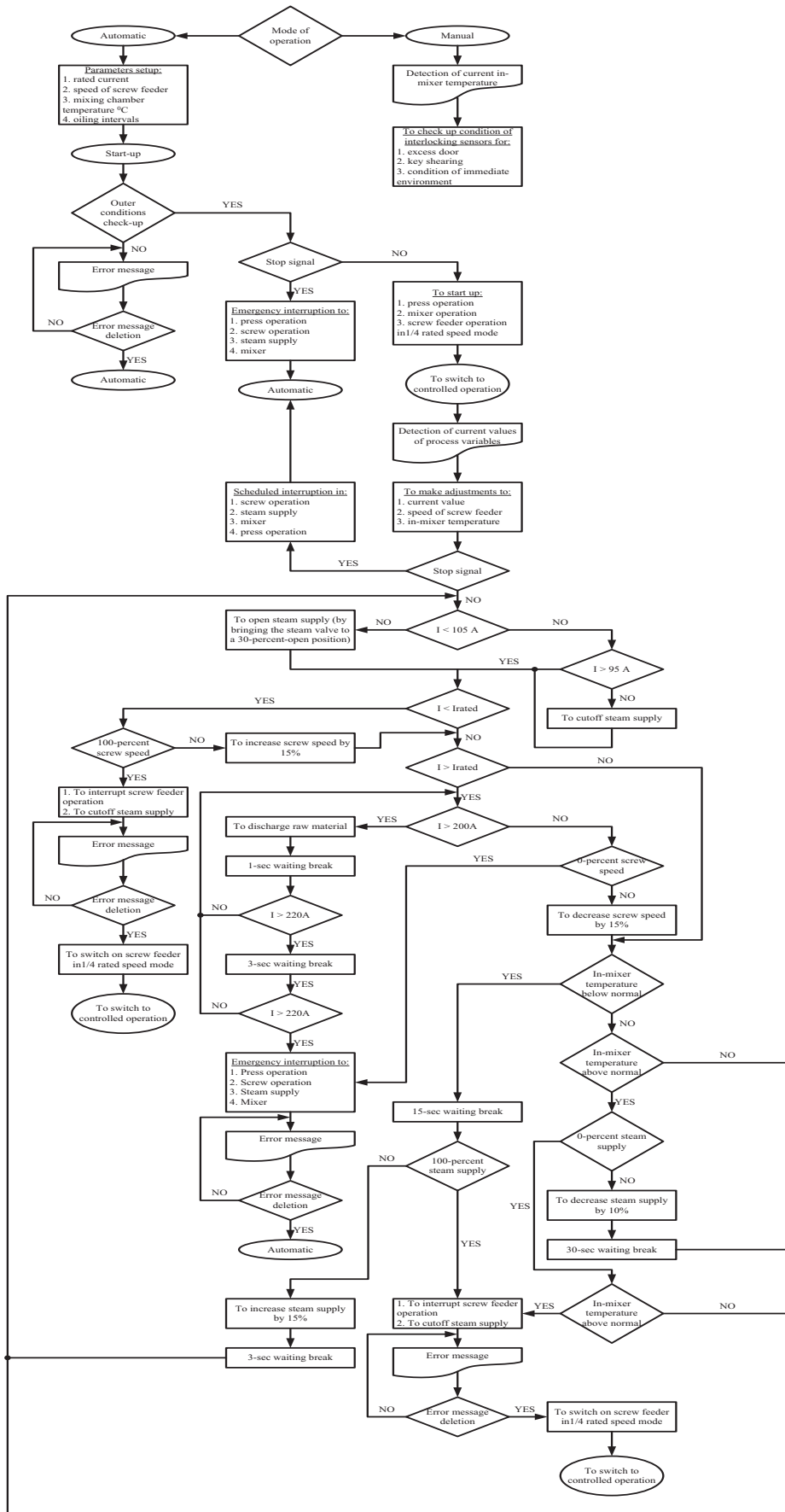


Fig. 2 – Algorithm of the automatic control system for granulated mixed fodders production, based on programmable logic controller