STUDIES ON THE IMPLEMENTATION OF AUTOMATED SYSTEMS TO PREVENT THE TECHNICAL PROBLEMS RAISED DURING THE PRODUCTION PROCESS OF COMBINED FODDERS

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Abstarct: *This article proposes a study on the way the installations of fodder kitchens are constructed and used,in order to remove the tehnical problems and to ameliorate the compound feed production process. In this way there are presented some aspects of technological process of making mixed fodders, emphasizing the grinding stage, and there are analyzed certain problems that can appear, following the ways of improving this activity by the use of some automatic systems. The automatic installation for grinding cereals is meant to be used in factories of mixed fodders, especially in those where the final grist is transferred to the next step of processing by mechanic transport with elevators or snail-conveyors.*

Keywords: *combined fodders, mills, grinding, air filter, technological process, automation*

INTRODUCTION

Continuous improvement of Romanian products in terms of performance and quality and diversification to meet the recipients are the main factors ensuring the competitiveness of agricultural market. In this way, the most important national interest of Romania should develop a competitive economy through quality, able to cope with current trends of international trade. Our country should have in the development of all branches of the economy in line with EU requirements and standards. Among other things, this fact requires the alignment of all products – both industrials and consuming – in accordance with the community rules referring to quality, security and environment.

To achieve this purpose all the equipments and installations that are used have to respect the essential conditions of health and security, imposed by the in force legislation, by integrating them in the stages of conception, fabrication and utilization. It is also necessary refurbishment of most capacity, equipping them with modern equipment, efficient, highly mechanization, automation and computerization.

These automated facilities for grinding grain are intended for use in compound feed factories, especially those that result grist is transferred to the next stage of processing by means of mechanical transportation with elevators or horizontal conveyors.

ASPECTS ABOUT GRINDING CEREALS IN MIXED FODDER FACTORIES. THE IMPORTANCE OF COMBINED FODDERS

In this period, the globe population has overran the 6,4 thousand millionth people with a rate of growth of 1,2 – 1,3%. The population migration from village to town, phenomena that can be seen in our country also, leads to an increased growth of animal products, that must be supplied by a fewer number of animal farms, but with bigger productive capacities.

In the figure 1 and figure 2 is showed the evolution of global population and also the evolution of global production of mixed fodders, and in the third figure, as a result from the other two, the medium consumption of mixed fodders per capita, in the last 30 years.

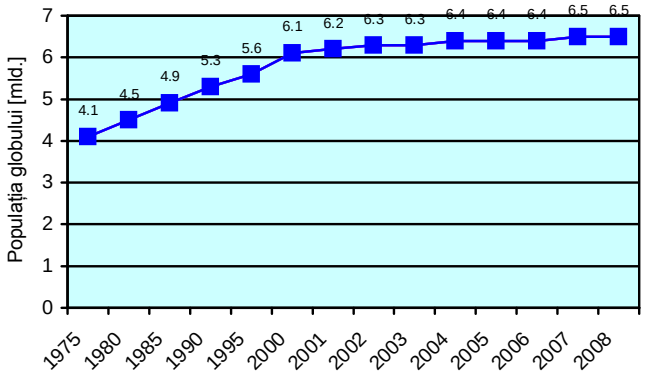


Fig. 1 The evolution of globe population

It comes out that by the year of 2000 the world wide production of combined fodders has been growing as slowly as population, while the consumption of mixed fodders has established at 96-97 kg per capita. On extended areas , the differences are though big as in concerns both production and consumption.

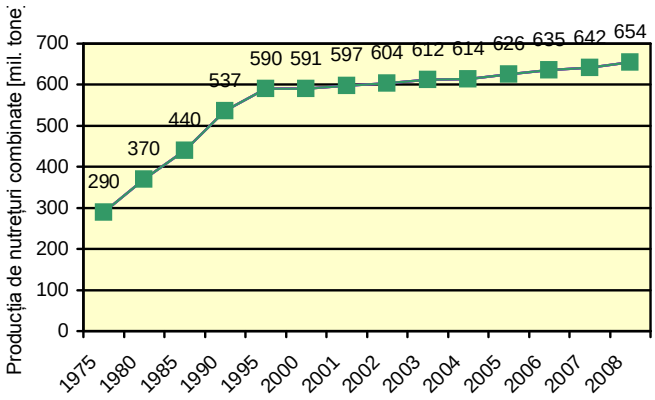


Fig. 2 Evolution of world wide production of combined fodders

So, for example, in 2008 the world wide production of combined fodders made industrially was about 654 mil. tones, the biggest part of it, of 162,8 mil. tones being produced in USA.

Having a production of 2,8 mil tones, our country is over the world wide average of mixed fodders production per capita, but still much under the agricultural possibilities of supplying raw material and of the zootechnical sector to use them. The European Union on the whole is the second world wide producer of mixed fodders, with a 141,6 mil. tones production.

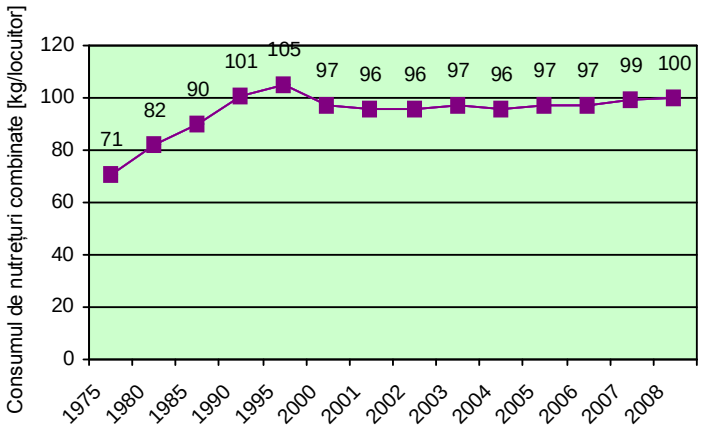


Fig. 3 Evolution of combined fodders consumption

In this graphic we can observe that there is a tendency in recent years to grow fodder consumption per capita combined with positive results in the development of this branch of agricultural industry.

THE TECHNOLOGICAL PROCESS OF MAKING COMBINED FODDERS

In this tehnological process, must have known that combined fodders are mixtures obtained by mixing certain animal and vegetal fodders with mineral salts, antibiotics, vitamins, enzymes, medicinal substances, using some formulae that want to correspond to physiological necessities of different categories of animals. The main advantage of using mixed fodders in feeding animals consists in reducing costs of animal products.

In most cases the cereals used for feeding animals appears in the shape of grains of different size and dimensions. To realize nutritive mixtures as homogeneous as possible, the preliminary grinding of grains is necessary, operation which in factories of mixed fodders is realized in the very first step of the process, in mills with hammers.

To obtain such a compound feed for animals must respect a certain technological process, whose main steps are:

1)Receiving row materials
2)Processing row materials
3)Grinding row materials
4)Dosation as in the formula
5)Homogenization of row materials
6)Granulation (for factories technological stage is imposed)
7)Packing and delivering the final product.

Each of these stages need a series of equipments and professional utilities, bunkers for storing the product, auxiliary equipments, etc. In modern factories, the whole technological flux is watched and commanded by an operator. In dosing stage, the concentrate PVM must be added (a complex of proteins, vitamins and minerals) which can be prepared or received from another supplier. The quality of the product must be controlled after each stage, depending on preestablished criteria, to assure the quality of the final product and the mixed fodder delivered to the beneficiary.

From among these technological phases , for the actual study, the phase of grinding the grain presents the largest interest, which is one of the factors influencing the quality of the final product. It is very important that cereals, which represent the largest component of a compound feed/fodder to be grinded as uniform as possible and that the amount of feed powder to be as small as possible. Milling operation is performed in hammer mills (..... Fig. 4), this process continuing to repeat until the particles reach a sufficiently small size to allow them to pass through the holes of the hamer mill's sive.

It has been found that the share of different categories of grinding mass fractions, for the same size of sieve's mesh, are substantially similar, their average value being shown in the graph of figure 4.

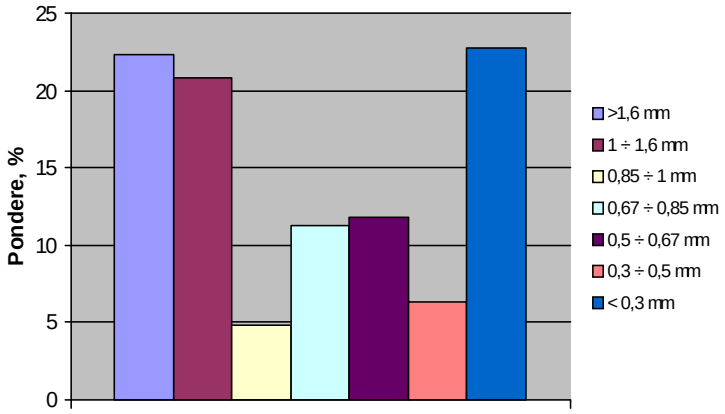


Fig. 4 - The share of fragments/fractions in the grinding mass

As it can be seen the particles with the smallest size,under 0.3 mm, have an important share, of over 20%. In this part there are many particles with extremely reduced sizes that, inevitably, when manipulated, are involved in the air as dust, phenomenon that should be avoided.

SPECIFIC PROBLEMS OF GRAIN MILLING PROCESS

All grain processors, including those who produce compound fodder, must constantly pursue the following objectives if they wish to maintain their position on the market:
- reduction of production costs of the finished product;
- maintenance of product quality according to customer standards or requirements;
- compliance of regulations in forms on environment safety and protection.

1. Reducing production costs

For any technological process, therefore also for the production of compound feed, the production costs include several components, the main ones being the cost of installation/equipment, that is the initial investment and the operating costs.

In the case of the crushing of grain, reduction of costs is reflected in the growth of the capacity of milling(tons / hour) ,along with the reduction of the specific energy consumption (kWh / tonne), these being the parameters which define the efficiency of grinding facility in question. In this way the following versions of technology to increase milling capacity and reducing costs can be presented:

A. Reduction of grinding raw materials costs, technological phase with the highest consumption of energy ,can be achieved in two ways:

a) with two machines for grinding: a roller mill for crushing coarse grains and a hammer mill for fine grinding, in order to ensure a continuous operation (Fig. 5);

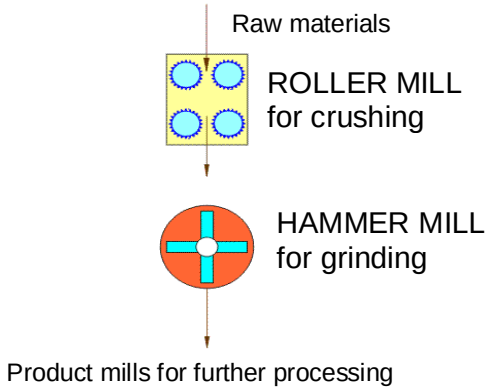


Fig. 5 - Grinding with two mills

b) with a single grinding mill, which can work:
- in charge: first a coarse grinding followed by fine adjustment of the mill and another grinding of charge
- in continuous flow, by sieving the crushed product and recycling the refusal grid (Fig. 6).

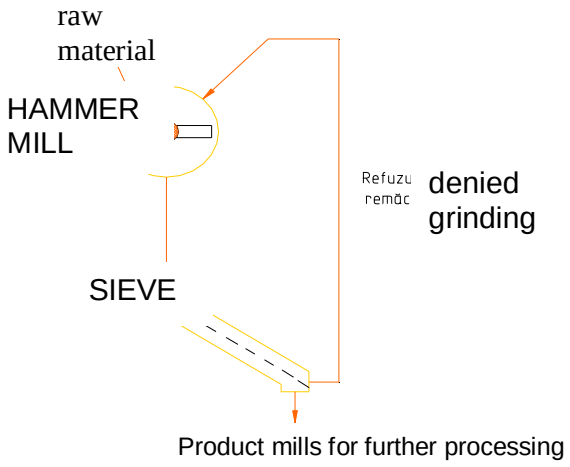


Fig. 6 - Grinding with a die, with sifting and recycling of the denials

B. The increase of the capacity of grinding of a hammer mill can also be obtained by:
- reducing the clogging of holes of hammer mill's sieve, a very important operation, especially for sites with small holes. This requires the existence of an air current that helps the particles to pass through the sieve's holes, or the use of a fan to pick up the mill;
- recovery of fine particles of grinding that tend to get out in ambient air and their direct return to the basic product with the help of one bunker for decantation and of an air filter.

The two solutions presented above are complementary and can be combined in the grinding scheme presented in Fig. 7.

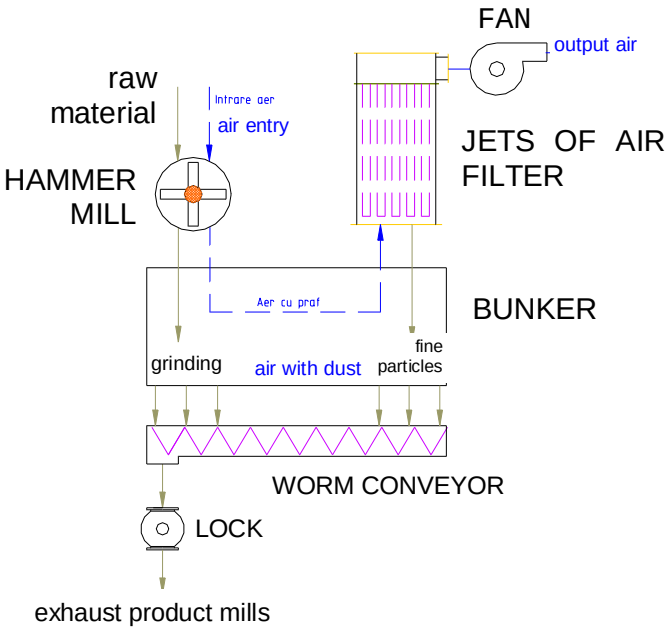


Fig. 7 - Layout of grinding with integrated system of suction and filtration

2. Temperature problem

In the hammer mills the electricity from the engine is converted into mechanical energy between hammers and sites in order to crush the grain cereals and to evacuate the grinding from the mill. Inevitably, a part of this energy is lost as heat during the collision of particles with hammers and sites. But it is necessary that this energy loss, namely the increased temperature (Δt) in the grinding chamber does not exceed a minimum value because:
- it can degrade the nutritional components of ground product;
- it leads to: clogging holes sieve, reducing the capacity of grinding and increasing the specific consumption of electricity;
- after getting out the flour from the mill, a part of the water evaporates and produces condensation in transmission systems.

It is not recommended that, during the grinding, the product temperature increases with more than 5 oC, nor that it presents unusual changes, and therefore measures should be taken for the evacuation of the heat from the grinding chamber with an air flow, and limitation of the temperature rise Δt.

3. The problem of dust

Flour dust leaving the hammer mill tends to be discharged into the atmosphere, and if it is not accepted immediately and it discharges in the precincts , hall pollution and air contamination occurs, endangering operators' health. By discharging into the atmosphere, the air with dust in its suspension provokes the pollution of some larger areas and endangers of a large number of people. That is why, both inside the country and in EU there are rules and laws, becoming more and more stringent, limiting the emission of particulate matter in the atmosphere, including dust, in order to conduct an adequate environmental protection.

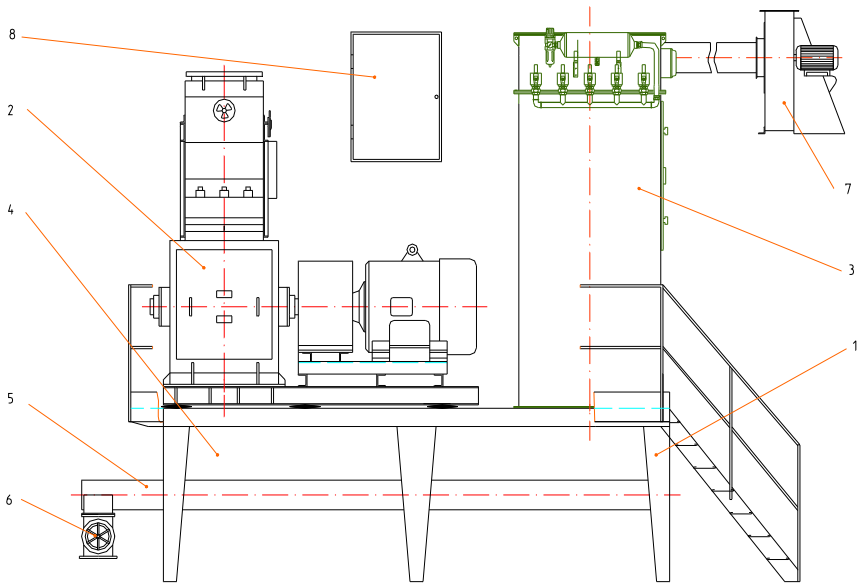
If a limit concentration is exceeded, organic dust can ignite or even cause an explosion in the presence of an open fire, a spark or of an electrostatic discharge.

Thus, dust retention from the technological air, before its disposal into the atmosphere, represents a need that has to be considered especially at equipment and facilities assimilation for the processing of grain.

RESULTS AND DISCUSSIONS

Being given the requirements outlined above, a facility for grinding grain forage within a fodder kitchen or FNC must go through the following technological flux:

- grinding grain in a single step, with a hammer mill;
- aspiration of the hammer mill with a suction fan to limit warming grinded product and increasing the capacity of grinding;
- filtering the air before being discharged into the atmosphere;
- using a bunker for collecting the grindingfrom the hammer mill and the fine flour retained by the filter.



1. Trestle; 2. Hammer mill; 3. FJA jets of air filter; 4. Bunkers product collection; 5. Truck worm - 6. Vocal - 7. Fan - 8. Plant automation

Fig. 8- Sketch grain milling plant

The tehnological process of grinding plant consists of (Fig. 8):

1. Platform with ladder access, on which technological equipment is mounted;
2. Hammer mill;
3. air filter with FJA 25;
4. Bunkers for collecting the ground product from the mill and fodder dust retained by the filter and shook by the jets of air;
5. Drag product for taking ground product from the bunker;
6. Lock suction system to ensure tightness of hammer mill;
7. Centrifugal fan to create necessary airflow ;
8. Plant automation for the control of electric engines/motors driving the moving bodies, which also contains the automatic plant for cleaning of the filtered elements.

CONCLUSIONS

♦ To achieve a functioning market economy according to EU requirements is necessary to use modern equipment, efficient, highly mechanization, automation and computerization, with high productivity and low specific consumption.

♦ Manufacturers of compound feed production facilities seeking to improve the technical and functional parameters. Thus, although differences between manufacturing firms, most manufacturers try to solve problems with a grain of suction and air filtering through the mill.

♦ An automated facility for grinding cereals for use in compound feed factories, especially those where grist result is transferred to the next stage of processing by mechanical transport (elevators and conveyor worm).

♦ Milling plants can be used in mixed fodder factory can adapt to new or existing plants to increase productivity, improve operating conditions of the hammer mill and reducing the quantity of dust discharged into the atmosphere by limits. But these facilities may be used in any area where it is necessary grinding of cereals, such as breweries and malt, alcohol and yeast factories, etc..

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