The 3rd International Conference on "Computational Mechanics
and Virtual Engineering"
COMEC 2009
29 – 30 OCTOBER 2009, Brasov, Romania

EXPERIMENTATAL RESEARCHES REGARDING THE DENSIMETRIC SEPARATOR FOR CLEANING OF THE WHEAT DESTINED TO MILLING

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Abstract: *It takes in view within the paper the designing, achievement and experimentation on production conditions of one densimetric separator destined to achieve the elimination of the hard impurities from seeds mass. The gravitational separation achieves under simultaneous action both of air current and vibratory motion of working surface. So, the separator has in its composition mechanical equipment having a vibratory motion and an aspiration pneumatic installation*
Keywords: *densimetric separator, wheat cleaning, wheat milling*

1. INTRODUCTION

Cleaning of the wheat before milling is a complex technological process that includes more constructive types of machines and installations for the separating and removing of the impurities from grain mass. Elimination of the impurities being in the grain mass carries out by more technological procedures depending on their physico-mechanical characteristics. In this way, a part of impurities are eliminated depending on their size (width, length, thickness), other are separated depending their lift coefficient. The impurities that have shapes very closed with the grain ones are separated by mixed technological procedures such as: separation by specific mass. This technological procedure is only used after the cleaning and separating of the grain after sizes, by sieves and sorters, and after the floating speed in the pneumatic rooms. The separation of the mixtures after specific mass achieves both as effect of the combined action of one continuous, ascendant air flow having constant pressure that acrosses the grain stratum being on wire cloth surface, inclined after two directions (longitudinal and transversal) and of this surface vibration. So, due to simultaneous action of the vibration and a air flow, it obtains the stratification and the imposing of the different trajectories to seeds. The heavy particles will set in direct contact with the operation surface, they will be subjected to more intense vibration and they will be driven to propagation direction of these ones. The easy particles will be set to upper part of the strata and they will be driven less to oscillation direction.

2. MATERIAL AND METHODS

It was designed and achieved a densimetric separator having 2 - 4 to capacity for equipping of the wheat cleaning technological line destined to grain milling (Fig. 1). The separator is a complex structure equipped on inferior part with operation surface made up from wire cloth and discharging pipes of the product after separation. On the upper part, the case is provided with aspiration and feeding pipes. Each pipe has one clack for regulating air flow respectively feeding product flow. The case is provided with plastic visor for the controlling of operation process.

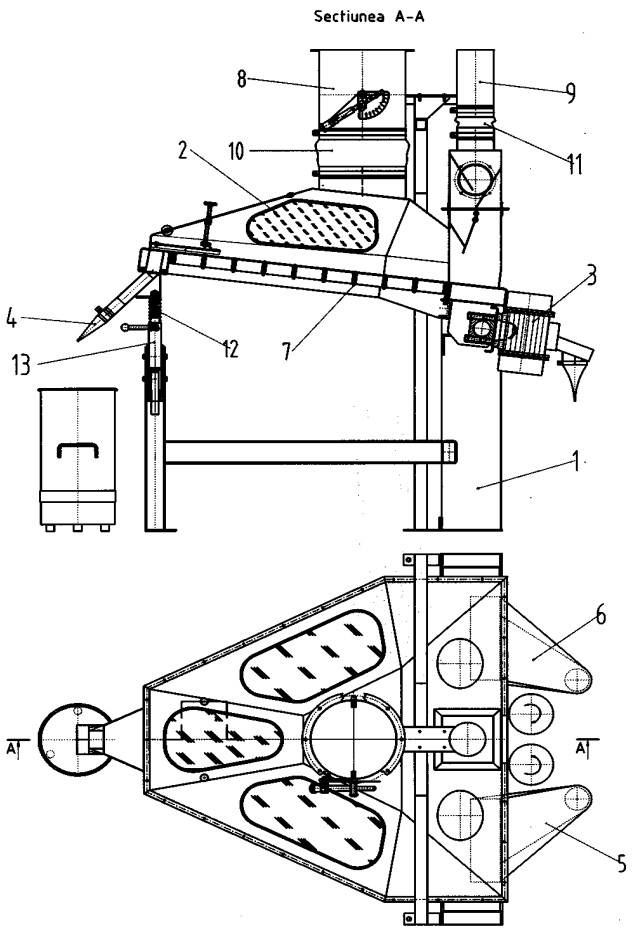

Figure 1. Constructive sketch of densimetric separator:
1 - sustaining frame; 2 - separator case; 3 - driving system with vibration engine; 5, 6 – finished (cleaned) product discharging pipe; 10- air aspiration pipe**;**11 - product feeding pipe; 12 - pipe for discharging heavy impurities; 13 - screw mechanism

Separator case 2 is fixed on a sustaining frame 1 by one elastic (springs) system and a screw mechanism 13 that regulate the inclination angle of the operation surface.The cleaning product is introduced in separator by 1)the feeding pipe and it is divided uniformly on the sieve operation surface. The product feeding flow is regulated by means of one clack. Under the oscillations action and of air flow, the heavy impurities are moved to upper side of the operation surface but the grain are moved to inferior side of the wire colth, after that they are evacuated by two connecting pipes 5 and 6 . The wheat cleaning process is influenced by the following parameters: product feeding flow; air flow; inclination angle of the operation surface and the amplitude of the oscillatory motion. The product and air flows are regulated by means of clack being on feeding connection pipes.

The inclination angle of the operation surface is continuously regulated (betwen limits $5…10^0$) by means of the screw mechanism that fixes the case against frame. The amplitude of the oscillatory motion is regulated between limits 1.5...2.5 mm by modification of the vibrator with eccentric masses.

Table 1

The results of the tests effected for the determination of optimal regime of the densimetric separator

Wheat feeding flow (kg/h)	**Air flow (m^3/min)**	**Angle of operation surface (grade)**	**Amplitude of operation surface (mm)**	**Quantity of impurities separated at 1000kg of wheat processed (kg)**	**Observations**
0	1	2	3	4	5
1500	100	5	1,5	35,5	It is observed that for small air flow and the inclination angle reduced in the impurities mass are eliminated grain. In the same time with the increasing of the oscillatory amplitude and the reducing of the air flow, grain are eliminated by the impurities pipes
			2,0	38,6	
			2,5	41,2	
		7,5	1,5	33,4	
			2,0	35,1	
			2,5	37,2	
		10	1,5	31,6	
			2,0	33,7	
			2,5	34,8	
	125	5	1,5	26,3	
			2,0	29,2	
			2,5	33,1	
		7,5	1,5	24,5	
			2,0	25,8	
			2,5	27,6	
		10	1,5	21,3	
			2,0	22,8	
			2,5	23,6	
	150	5	1,5	29,7	
			2,0	21,4	
			2,5	23,8	
		7,5	1,5	16,4	
			2,0	18,2	
			2,5	19,4	
		10	1,5	15,6	
			2,0	16,8	
			2,5	17,9	
2000	100	5	1,5	37,6	
			2,0	40,2	
			2,5	43,4	
		7,5	1,5	35,6	
			2,0	38,9	
			2,5	39,9	
		10	1,5	33,3	
			2,0	35,4	
			2,5	36,7	
	125	5	1,5	28,1	
			2,0	31,4	
			2,5	34,9	
		7,5	1,5	26,6	
			2,0	27,4	
			2,5	29,1	
		10	1,5	23,1	
			2,0	25,1	
			2,5	26,0	

Table 1(continuation)

Wheat feeding flow (kg/h)	Air flow (m^3/min)	Angle of operation surface (grade)	Amplitude of operation surface (mm)	Quantity of impurities separated at 1000kg of wheat processed (kg)	Observations
0	1	2	3	4	5
2000	150	5	1,5	21,2	
			2,0	23,0	
			2,5	24,9	
		7,5	1,5	17,8	
			2,0	19,8	
			2,5	21,6	
		10	1,5	17,1	
			2,0	18,3	
			2,5	19,2	

3. DISCUSSIONS AND RESULTS

We set up the densimetric separator in a technological line for cleaning of wheat from the composition of one wheat mill having a capacity of 1400 – 1500 kg/h and we determined the operation characteristics of separator. We set the separator after aspirator separator and trieur within technological line for cleaning of wheat. So, the wheat that feeds the densimetric separator was subjected to cleaning after dimensions. It made tests for determination of optimal operation regime for different feeding flow of (1500 and 2000 kg/h) modifying in the same time the following parameters: aspiration flow of 100, 125, 150 m^3/min; inclination angle of the operation surface of 5^0, 7.5^0 and 10^0 and the amplipude of oscillations of 1.5 mm, 2.0 mm, 2.5 mm. The oscillations frequency was constant respectively: 960 osc/min. For all variantes, we weight the impurities eliminated of densimetric separator after the processing 1000kg wheat. The results are showed on table 1.
The wheat used for test of densimetric separator has a hectolitrical weight of 78.5 kg/hl.
It finds the following aspects after analyse of the experimental results:

- The performance of the densimetric separator increases by the increasing of air flow due to that it achieves a better stratification of product strata depending on specific weight of particles.
- By the increasing of the inclination angle of the operation surface, it diminishes the wheat quantity eliminated through impurities pipes. We have to mention that if it increases inclinating angle more then 10^0, the performance of separator becames worst.
- The oscillations amplitude influences the operation regime, in such way that for values of 2 and 2.5 mm the separator performance increases.
- It observes that, by increasing of the wheat feed flow through the impurities pipes are eliminated a part of basis crop grain..

4. CONCLUSIONS

The separator designed and achieved is a rugged construction, it operates non-vibrantly and allows the easy adjustment. The working process of the densimetric separator is efficient and it achieves a high cleaning of the wheat for milling. The technological parameters obtained during tests depend on the regulation of the operation surface (oscillations amplitude and inclination angle) of aspiration air flow as well as wheat feed flow. It recommends for a optimal operation the following regulation parameters: wheat feeding flow: 1500…200 kg/h; air flow 125… 135 m^3/h; oscillations amplitude 1.8…2.2 mm and the inclination angle of the operation surface of $6…8^0$.

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