EFFICIENT PELLET MILL FOR WOOD. Part 3. Summary.

Influence of design factors and force analysis

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The combination of design features of pellet mills, ... , makes each model unique in terms of the workflow. A direct consequence is greater or lesser energy efficiency of the mills, or their production potential with comparable engine power.

As was found when comparing pellet mills, the operating temperature varies greatly depending on the model (in the range from 85 to 145°C on pine, all other things being equal), and thermal calculation, reduced with experimental data, showed a difference in the final efficiency "on rollers" more than one and a half times.

This means that the initial identical kinetic energy from the engine (of the same power) is used with different efficiency. At the same time, different drive efficiencies give a relative differentiation of up to 8%, rollers cooling - up to 6%, but heat losses without taking uppers into account reaches 43%.

This result shows that the main cause of losses is not drive design, but their occurrence directly in the material and at the material-tool contacts.

The target is to find the influence of design factors on the acting forces of the process and the work they do.

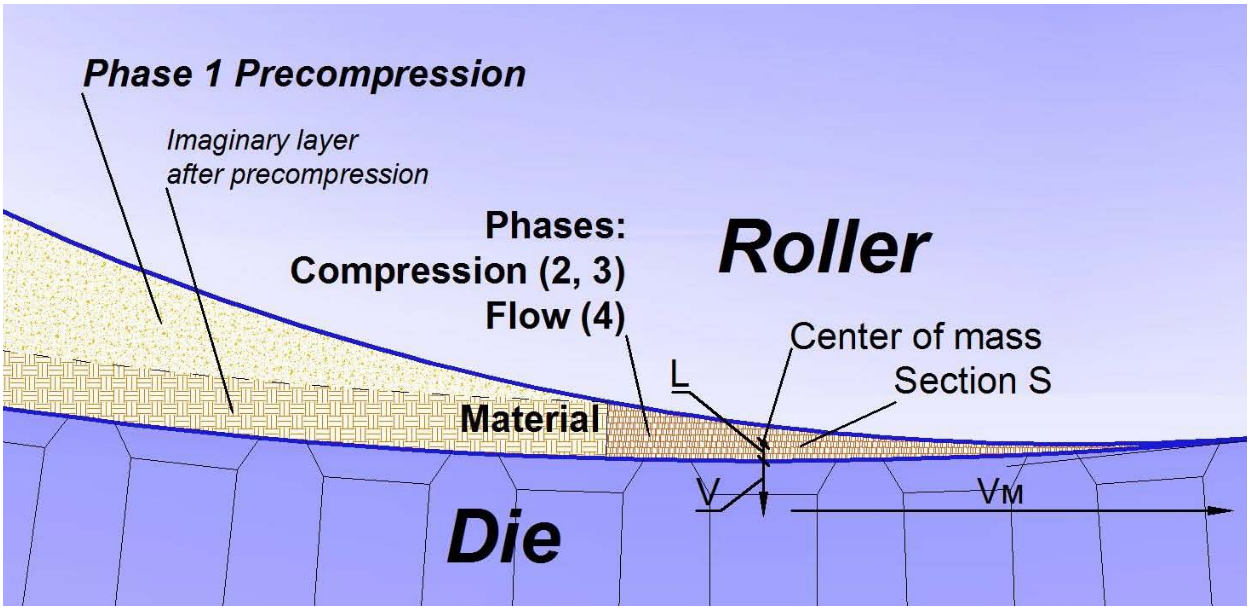

Fig.1. 5-phase process (phase 5 not shown) and influencing factors

ANALYSIS OF RESULTS

For some models of the mills, the relative coefficients of energy consumption K_e are calculated, then the functions of the operating temperature T_{work} from K_e are determined (Table 1, Fig.3).

Table 1.

No.	Model	Manufacturer / Type	Number of rollers	Coefficient of energy consumption K_e	Operating temperature T_{work} on pine, °C
1	PM30	Andritz	2	1,1	≥110
2	Maxima 840	Salmatec	3	1,06	105
3	CLM935	La Meccanica	2	1,28	≤135
4	HT – high temperature		2	1,59	≈145****
5	LT – low temperature		3	1	90

****If cooling of rollers, 20...35°C must be added to the readings of the temperature sensors

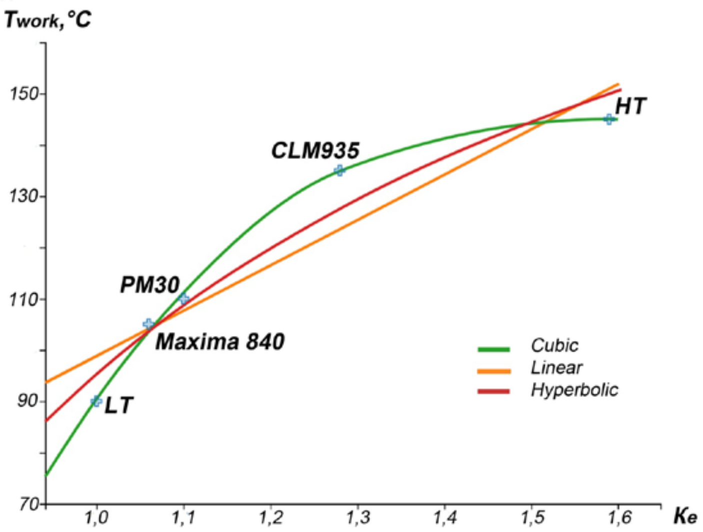

Fig.3. The Functions Graphs of the operating temperature T_{work} from K_e

EXAMPLES OF PELLET MILLS WITH SPECIAL COMBINATIONS OF FACTORS

Fig.4. Maxima 840

Fig.5. PM30

WORKING FRONT* ENERGY

Table 3. Specific energy of the working front, energy efficiency and number of rollers

	2 rollers	3 rollers	
Low sp. energy of the working front (abt. 15 J/cm^2)	**HT** **CLM935**	**Maxima 840**	**Energy efficiency** **min** **max**
High sp. energy of the working front (abt. 30 J/cm^2)	**PM30**	**LT**	

*Working front = die working width x number of rollers

CONCLUSIONS

1. The force analysis showed a difference in the selection from 1 to 1.59, i.e. more than one and a half times from the energy consumption of the LT pellet mill (K_e=1), which correlates with the results of thermal calculation.

2. The main influencing design factors are determined...
Their optimal combination, corresponding to the drive power, provides a significant increase in the energy efficiency. The best combinations were shown by three roller mills.