UDC 631.563.2

TO THE QUESTION OF DRYING OF SEEDS OF AGRICULTURAL CROPS WITH USING OF ALTERNATIVE TYPES OF FUEL

Petrachenko D.O., *Candidate of Technical Sciences*
Koropchenko S.P., *Candidate of Technical Sciences, Senior Research Assistent*

RESEARCH STATION OF BAST CROPS IANE NAAS

The results of research of fitness of improved heat-generator for drying of seeds of agricultural crops with the use of renewed types of fuel - stems of hemp are presented in the article.

Problem essence. The storage of finished seed agricultural products (sowing seeds, fodder grain) for a long time is one of the priorities of the industry nowadays. Damage of grain during storage can negate all the achievements of agricultural producers and also cause significant financial losses to agricultural enterprise.

Drying is the final technological operation of bringing seed production to sustainable storage conditions. Only after the removal of excess moisture grain weight and bring it to a state (humidity conditioning) can rely on its secure storage for a long period of preserving all its sowing and food properties.

The main and most effective way to remove excess moisture from seed is its evaporation in the result of drying. Using dryers reduces the time required to bring the seed to moisture and conditioning allows in a short time to prepare the seeds for sustainable, long-term storage [1].

The key problem of grain drying process lies in the high cost of traditional fuels (diesel, fuel oil, natural gas) which at times increases the cost of operation. This encourages manufacturers to seek alternative fuels, there is high interest in the use of alternative and renewable energy, including biomass (straw, stock, scutch). However, the use of biomass as an energy source, requires the use of special typical units, boilers, which cost very high and not every agribusiness has financial resources to implement such projects. So the question arises what is right by finding alternatives refurbishment and modernization of existing boilers will save a considerable amount on buying a boiler and drying grain.

Analysis of last studies and publications. The vast majority of modern drying systems based on convective drying method, in which the need for drying heat is transferred to the seed of the heated drying agent installation.As the drying agent can act as a heat fresh air and mix air with the fluel gases [2]. One of the wide-spread during the Soviet era furnace heating units for drying agent were various modifications FVU (fluel versatile unit). FVU designed to heat clean air or getting gas mixture in installations for

drying agricultural products and runs on liquid fuel [3]. The higher cost of fuel used in drying installations FVU was not justified.

At the base of the Institute of Bast Crops (now Research Station of Bast Crops) scientists was conducted to improve the work floor-dryer through improvement and modernization of FVU rolls into biomass crops [4]. It was designed and produced (Fig. 1) for combustion rolls which can simultaneously accommodate two rolls formed by baler PRP-1,6 (roll diameter up to 1.4 m, roll width 1.6 m), redesigned system diversion of flue gases (smoke), the system of giving cool air.

Production testing [4] showed the effectiveness of the scheme in drying various agricultural products (wheat, barley, hemp, flax, soybeans, corn). Drying time depends on the initial moisture corn, the total weight of the grain, the thickness of the layer dryer and more. It was established that on average to reduce moisture in 3,8-6,2% of the total weight of 10 tons of grain need 4 rolls of straw and 15 hours time.

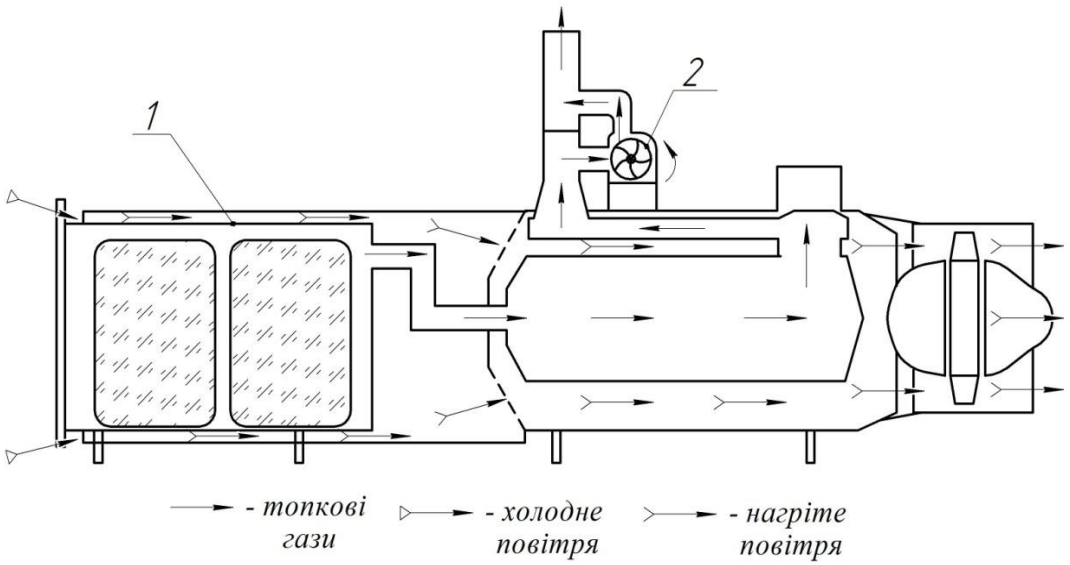

Рис. 1 *– The scheme of modernized generator for floor dryer:*
1 – chamber for burning rolls; 2 – fan of forced diversion of flue gases

However, in the long-term operation of the upgraded heat generators there are some problems initswork. The weak point was the system of allocation of flue gases, including fan forced fume (Fig. 1). The system fume based on the compulsory transmission of gases through the fan blades, through which the latter worked in dynamic conditions and harsh operating conditions (high temperature, large radial load, the presence of flue gases a significant number of pitches that are settled at blades), which led to its breakdowns. As a result, how often (3-4 times per season), it was necessary to repair the fan and suspended drying process, which caused difficulties in bringing the issue of seed production to conditioning moisture. To put off this lack the works were carried out to improve the drainage system of fluegases.

Aim of research. To give a possibility of drying seeds using the injection method of diversion of flue gases in the scheme generator for floor-dryer.

Results of research. To solve the problem of diversion of flue gases it was taken on the base the principle of injection-based energy attracting additional air flow. This was changed the system fume (Fig.2). The use of energy of additional cleanair flow (directed in the direction of the main gas stream) allowed to redirect the main stream of fluegas bypass lopotiv fan forced abduction that removed the issue of extradynamic loads on the latter.

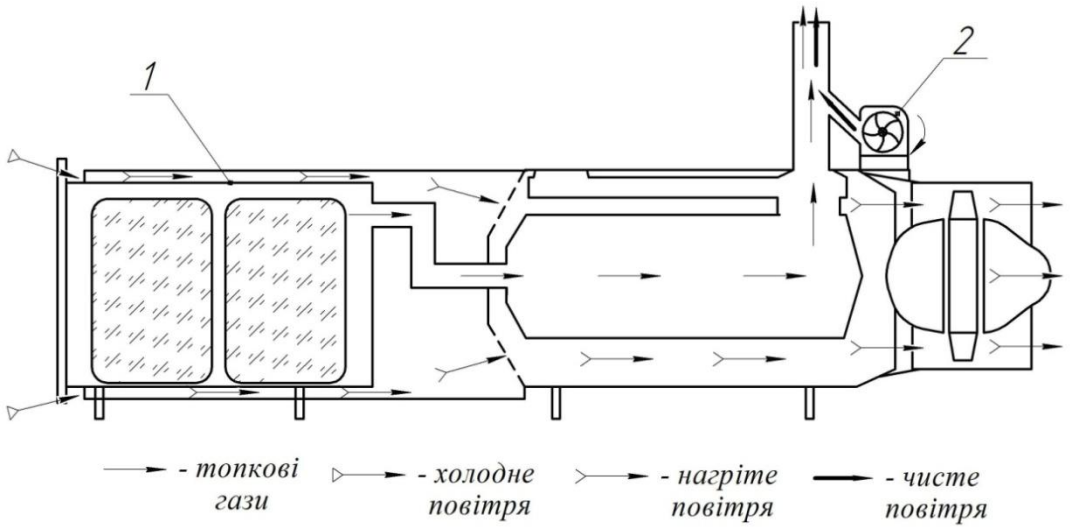

Fig. 2 *– The scheme of improved heat generator with fuel-injected diverting flue gases:*

1 – a chamber for burning rolls; 2 – a fan of forced diversion of flue gases

The efficiency of the drying process is conditioned properly chosen regime that determines the final quality of the seed. Under the regime of drying one provides a definite correlation of parameters parameters such as the temperature of the drying agent and the maximum allowable temperature ofseeds. For example by drying seeds of cereals (wheat, barley, oats) maximum permissible temperature of the drying agent 75 ^{0}C, and the temperature of seeds– 45 ^{0}C. For hemp seeds temperatures are 65 та 40 ^{0}C respectively. Moreover, with decreasing initial seed moisture is allowed increase (on 5-15^{0}C) of these temperature indicators. The correctness of drying seed increases its resistance to storage, improves food and crop qualities.

The process of changing temperature regimes as the drying agent and seeds, after making structural changes, investigated by the example of dry seeds of barley. Drying of seed material (placed on the grid of floor-drying) is due to the blowing of the material drying agent supplied through air heat source system of fan. Therefore, in the process of research there was monitoring of temperature conditions in the system of diffuser heat source

and on the grid of the dryer. The research of improved drainage systems flue gases during drying seeds are represented in the table.

***Table**– The dynamics of change in temperature during drying barley seeds in the process of burning hemp straw*

Burningtimes of the rolls, min.	Air temperature (on the sun), ^{0}C	Dryingagenttemperature in air flue system unit, ^{0}C	The temperature on the grate of the dryer, ^{0}C					
			beginning		middle		end	
			drying agent	seed	drying agent	seed	drying agent	seed
arson of the roll	34	37	33	27	30	25	30	25
25	34	47	39	29	35	26	35	26
35	34	50	41	30	36	27	36	27
50	34	49	42	32	37	27	37	27
65	35	47	42	33	38	30	37	29
125	36	46	43	38	38	37	37	37
185	37	41	39	40	36	34	35	32
215	37	36	34	37	30	29	29	27

As seen from the results (table) the temperature parameters as a drying agent and the seeds are in the normal range. The highest temperature of the drying agent (in the contact with the seeds) 43 ^{0}C, and seed material – 40 ^{0}C, which is extremely important for conservation of sowing qualities of seeds.

The temperature of the drying agent depends on the stability of the combustion process of stems. At a constant air temperature (34 ^{0}C) it was observed the increase of temperature of drying agent (in the air system) from 37 to 50 ^{0}C for the first 35 minutes of burning. It was during this period is intense burning of the roll. With further increase in temperature to 37^{0}C, the temperature of the drying agent starts to fall to 36^{0}C for the burning process of raw material goes to end (215 min. from starting of burning).

To seed material on the grates the drying agent is coming with lower temperature than the air in the heat source systemwhich indicates heat loss in distribution arms. Depending on the place at the dryer (beginning, middle, end) the temperature of drying agent also changes by an average of 3-5^{0}C. The lowest temperature of the drying agent accounted for the most distant (30 m) from the heat source point - the end of the dryer. However, this does not prevent the seeds to warm up to 27-37^{0}C. Moreover, in the process of seed drying is its mixing with the help of reeling device that changes seed position regarding grates of the dryer.

Conclusion. The use of renewable energy including straw of crops is an alternative to traditional fuels in the process of post harvest processingof seed material. Use of injection method of allocation of flue gases during straw rolls burning providesall the conditions necessary to preserve the quality indicators of seed sawing material.

1. *Организация* и техника хранения зерна / [О.С. Воронцов, М.Г. Голик, В.Н. Делидович, И.А. Клеев и др.] ; под.ред. И. П. Козьминой. – М.: Издательство технической и экономической литературы по вопросам заготовок, 1954. – 359 с.

2. *Послеуборочная* обработка и хранение зерна / [Е.М. Вобликов, В.А. Буханцова, Б.К. Маратов и др.] ; под.ред. Е.М. Вобликов. – Ростов н/Д.: Издательский центр «МарТ», 2001. – 240 с.

3. *Топочный* агрегат универсальный ТАУ-1.5А [Электронный ресурс] – Режим доступа: http://www.mtu-net.ru/inkomtechprom/Descr/Teplov/Descr01.html

4. *Примаков О.А.* Дослідження процесу сушіння насіння льону-довгунця відновлюваними видами палива / О.А. Примаков // Нові наукові дослідження в селекції, технології вирощування та переробки технічних культур: мат. наук.-практ. конф. молодих вчених, 8-10 грудня 2012 р. – Суми, 2011. – С. 118-123.