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EFFICIENCY OF GRAIN HARVESTER WITH CLASSIC SCHEMETHRESHING-SEPARATION DEVICE AND WITH AXIAL-ROTOR TYPE

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Combine harvesters with a classic threshing-separating device scheme have gained the greatest distribution throughout the world. Characteristic features of this type of threshing-separating device are the presence in the design of a ball or pin threshing drum and a keyboard straw shaker. Due to the structure of the straw shaker, combines with a classic threshing-separating device scheme are also called keyboard combines.

Threshing of the bread mass in the threshing-separating device of the classical type is carried out due to impacts and wiping of the bread mass, which moves tangentially in the gap between the drum and the drum. Part of the grain, together with chaff and small impurities, falls through the drumming grid and is directed to the sieves of the grain cleaning system, and the threshed mass, which still has a lot of grain, moves further and enters the straw shaker keys. As a result of the reciprocating

movements of the keys, the bread mass is moved and loosened, and its final separation takes place.

The scheme of action of a threshing-separating device of the classic type is designed specifically for harvesting grain crops and is traditional for such a process. Keyboard-type combines are well suited for working with wheat, barley, rapeseed, etc. Combine harvesters with a threshing-separating device of the classic type work quite reliably in difficult harvesting conditions: weediness, high humidity of straw and grain. Note that these are the easiest to set up and the cheapest combines.

The specific nominal throughput of combines with a single-drum threshing-separating device of the classic type ranges from 4.8 to 5.9 kg/s per 1 m of thresher width. The results of research and tests show that the increased specific nominal throughput of combine threshers with this type of threshing-separating device can be realized only under favorable harvesting conditions. Under the conditions of harvesting wet and littered crops, the separating surfaces of the threshing-separating device are stuck with wet plant mass and soil. On overripe bread mass, such threshing-separating devices overload the grain cleaning system of the harvester with crushed straw particles. As a result, both in the first and second cases, grain losses behind the thresher of the combine grow.

The peculiarity of combine harvesters with a threshing-separating device of the classic type is that as productivity increases, grain losses in straw increase sharply, even under favorable conditions. Under the conditions of harvesting high-yielding fields or in difficult conditions, such combines can allow large losses of grain. Thus, according to the results of the tests, when the thresher was overloaded by 8–11%, the loss of grain by grain harvesters with a threshing-separating device of the classic type increased twice (from 1 to 2%), and when the supply increased by 15–23%, it increased by 4 times.

In order to increase the productivity of keyboard combines and reduce grain losses, leading companies are constantly improving threshing and grain separation systems.

Increasing the efficiency of threshing-separating devices of the classic type is carried out in the direction of increasing the angle of the deck drum girth, the area of separation, increasing the number of drums (multi-drum threshing-separating devices), working out the parameters of the working surface of the deck (Fig. 1).

These structural innovations are primarily aimed at ensuring maximum separation of grain in the area of its milking and a corresponding percentage reduction in straw entering the key straw shaker for final separation. It should be noted that for the high-quality operation of threshing-separating devices of the classic type, it is necessary that about 90% of the grain is separated from the bread mass through the drumming of the threshing devices, since the keyboard straw shaker is capable of separating only about 10% of the grain.

The intensification of the separation of grain from a coarse pile on a key straw shaker is achieved thanks to the lengthening of the keys to 4600–5000 mm, an increase in the area of the straw separator to 7.5–7.7 m², the use of devices and mechanisms (beaters-separators, stirrers above the straw shaker, etc.) that ensure

higher quality operation of the system with bread mass of high straw content and a significant amount of weeds.

Fig. 1. Grain-harvesting combine with a multi-drum threshing and separating device

In combines with threshing and separating devices of the axial-rotor type, the main working body is a longitudinal rotor placed in a cylindrical tray. It replaces the threshing drum, beater beater and straw shaker. In rotary harvesters, the threshing and separation processes take place simultaneously in a single working body. The front part of the rotor threshes the bread mass, and the rear part separates the grain. For the axial movement of the mass along the axis, bulls or vanes are installed on the rotor, and guides are placed on the deck along a helical line.

A significant part of the grain in rotary threshing systems is separated due to wiping and centrifugal force, so the grain is less damaged and better retains its sowing and marketable qualities. Thanks to the intensification of the separation process in the rotary working bodies, minimal grain losses are ensured even with high crop yields and high humidity. However, under such conditions, the proportion of chopped straw increases, and the bales formed from it are poorly picked up by the baler, which leads to unproductive losses of straw in the field.

Harvesters with threshing-separating devices of the axial-rotor type have attracted the increased interest of specialists since their appearance on the market. Let us note the advantages of threshing-separating devices of this type, comparing with classical and combined systems: high intensity of threshing and grain separation; the level of grain or seed damage is lower; increased stability of work quality indicators in changing assembly conditions; compactness and simplicity of design.

Combine harvesters with threshing-separating devices of the axial-rotor type are advisable to use under high yield conditions. Optimal conditions for using this

type of combine harvester are low humidity. Unlike the keyboard, the axial-rotor combine is more efficient at harvesting corn and sunflower.

The main disadvantages of axial-rotor combines include: sticking of the separating surfaces of the tray with raw plant mass and soil; twisting the straw mass into bundles under the conditions of harvesting wet long-stemmed crops, especially those clogged with weeds; increased energy consumption vs. threshing-separating devices of the classic type.

Under the conditions of harvesting grain crops with axial-rotor combines, in which the mass of straw is greater than the mass of grain, and the stalks have not lost their strength, specific fuel consumption increases by 20–30%.

During operation of the device, foreign objects that could cause deformation of the rotor are not allowed. In case of repair, its dynamic balancing is required, which is carried out in factory conditions.

According to the results of studies of a number of combine harvesters, in particular those with rotary threshing and separating devices, in different natural and climatic zones, it was established that combine harvesters with a rotary scheme provided additional grain harvesting in the amount of 2.2–3.1 t/ha. The grain crushing level of 0.4–0.6% in combines with such threshing-separating devices is significantly lower than in combines with a classic scheme of 2.7–7.9%.

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