TO THE RESEARCH INCLINED CAMERA OF HARVESTING MACHINE

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Abstract: We propose a new method to research technology and testing of a new generation of inclined camera of harvesting machines, in particular method of determining the coefficient of biomass leveling on the inclined camera connected with non-uniform load across the width of harvester, influence of non-uniformity on indicators of threshing and separation, determining the cause resulting in such loading from the research work on different types of agricultural crops.

Keywords: Harvesting machines, inclined camera, video camera, biomass leveling coefficient determination.

Introduction
On grain producing system works the most responsible and stressful stage is harvesting.

In technological process of harvesting machines essential influence on it has inclined transporter receiving forming and feed grain mass flow into the threshing barrel.

The review of transporter receiving and inclined cameras, allows to divide carried research in the following areas: 1) setting the threshing barrel as well directly into the inclined camera; 2) reliability investigation of inclined transportor work; 3) partial threshing grain in the inclined camera; 4) the use of inclined transporter for ensuring of uniform supply layer of grain mass to threshing device. Creation of a competitive and perspective inclined camera of new generation in harvesting machines makes very high demands and, above all, in part of improving modern knowledge and methods.

To carry out laboratory research to optimize the parameters of innovation (improved) inclined cameras was proposed "smart technique" (Smart Factory), which applied to create in practice new technologies a more flexible production with investigations of processes in inclined cameras next generation ability, to better meet the needs of each researcher.

Is provided a method of determining the coefficient leveling of biomass Is known rice grain harvester with the arrangement of the workers and transporting bodies on the T-scheme [1], in which the flow of biomass entering the threshing machine, regardless of the technology of harvesting (direct or separate combine harvesting), narrows to a width of tilt camera., connected with no uniform loading on width of the harvester, influence of non-uniformity on indicators of threshing and separation, the establishment of the reasons leading to such a load during research on different types of agricultural crop.

The prerequisites and means to solve the problem
Is known rice grain harvester with the composition of the workers and transporting bodies on the T-scheme [1], in which the flow of biomass entering the threshing machine, regardless of the technology of harvesting (direct or separate combine harvesting), narrows to a width of inclined camera.

Is established that rollers formed swathed or stream forming direct harvesting, have an uneven allocation biomass (plant) in both the longitudinal and transverse directions.

During threshing of these flows of biomass due to insufficient taken away action unevenness of transporting workers increases, setting the stage for an uneven TSD charging. Therefore, in the research and testing of a new generation tilt camera rice combine harvester is very important factor determining the accuracy of biomass leveling.

Is also known, way to improve performance combine by uniform loading of working bodies, such as biomass distribution across the width of inclined camera device for implementing [2]. Here, the ratio of biomass is estimated clogging leveling thresher combine biomass, i.e. frequency of having to stop at the threshing biological mass. The specified way of an assessment and coefficient determining, leveling inclined camera biomass harvesting machine is susceptible to considerable error and will not be able to accurately determine the coefficient of pulling apart of individual stems working bodies of tilt camera, influencing the uniformity of combine TSD charging. The main factor to determine accuracy of measurements coefficient leveling biomass coming into TSD harvester has a maximum value → 100% only in the automation of the processes under study displacement and video fixation colored stems in a laboratory (stand).

In the known apparatus and processes, for example, combine harvesters equipped with ultrasonic obstacle detection system for harvester perimeter, video surveillance system on the perimeter of the combine and in specified areas, to maintain optimum system settings in the cab, system of semiautomatic and automatic control of the combine, the remote control system a group of combines in manual, semi-automatic and automatic regimes (when harvesting crops: barley, millet, wheat, rice, buckwheat, peas, rye, oilseeds and herbs, etc.) [3], as well as methods of creating the graphic data bank for the evaluation of images, wherein the individual images is generated image data bank during the process of harvesting the agricultural working machine with at least one camera, and individual images are correlated with the characteristic data of working process agricultural working machine and each correlated with the characteristic data is recorded in a separate image bank.

The specificity of the research lies in the fact that the video recording and analysis of images was carried out in the field conditions using a portable video camera (viewing based on the video camera). Coordinates of the original location portion of each painted ear of corn stalk which is relative to the central axis along the inclined camera, and then, after transportation of biomass inclined camera output by fixing agent discharge conveyor measure the offset coordinates corresponding colored stems relative to the same reference system, after which count the average numerical value of the difference between the most and least biased offset coordinates of the corresponding colored stalks and evaluate leveling factor of biomass by the formula [5].

Method is realized device for determining the coefficient of leveling biomass, which includes inclined camera harvesting

Measurements coefficient leveling biomass coming into TSD harvester is absent.

Another known method determining the coefficient of leveling biomass, containing biomass feed conveyor feeder to the distance piece and inclined camera harvesting machine followed by evaluation of the coefficient of leveling by coloring n-th part stems from feed a layer of biomass, and then through the locked feeder measure the coordinates of the original location portion of each painted ear of corn stalk which is relative to the central axis along the inclined camera, and then, after transportation of biomass inclined camera output by fixing agent discharge conveyor measure the offset coordinates corresponding colored stems relative to the same reference system, after which count the average numerical value of the difference between the most and least biased offset coordinates of the corresponding colored stalks and evaluate leveling factor of biomass by the formula [5].

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Solution of the given problem

Offered the new method determining the coefficient of leveling biomass coming into TSD harvester [6] comprising supplying biomass conveyor feeder to the distance piece and inclined camera of harvester then assessment of coefficient leveling biomass by counting the numerical value of the difference of the maximum displacement and less offset coordinates corresponding stems from the formula then assessment of coefficient leveling biomass by counting the numerical value of the difference of the maximum displacement and less offset coordinates corresponding stems by formula (1), -th of the colored layer of stalks supplied to biomass is fixed video camera №2 corresponding coordinate offsets of colored stems, after which count the average numerical value of the coefficient of the DVR records the biomass by video camer №1, then discharge conveyor system is fixed video camera №2 corresponding coordinate offsets of colored stems, after which count the average numerical value of the coefficient of the DVR records the formula. At the same time research of the process pulling apart colored stalks exploring indications video cameras №3 and №4. A device for determining the coefficient of leveling biomass includes inclined camera 1, spacer 2 with a feeder conveyor 3 and 4, which is located near steering vertically and navigate through conveyor 4 video camera №1 (Figures 1 and 2). Also for the release edge inclined camera 1 made discharge conveyor 5 with a similar moving pillar 6 video camera №1. Determination of coefficient of leveling of biomass on this device is carried out as follows.

In the weighed portion of the biomass by video camera №1 original coordinates fixed butt and spikelet’s, part of multicolored painted stems, relatively central axis inclined camera. Then biomass is supplied by transporter 4, feeder 3, a spacer 2 and in new generation inclined camera 1. After going through investigated and optimized working bodies tilt camera, they get on the discharge conveyor 5. Here, well from through video camera №2, regulating it vertically and moving from post 6 along the conveyor 5, measure the offset coordinates butt, ears, different multicolored painted stalks, relative to the same reference system, and then count the average numerical value of the coefficient of the DVR records the following formula:

$$\mu = \left( \Sigma x_{\max} - \Sigma x_{\min} \right) / \Sigma x_{\max},$$  

where $\Sigma x_{\max}$ - the maximum displacement painted stems, mm;  
$\mu$ - coefficient of leveling, are counted a numerical value the coefficient of leveling plant mass.

At the same time research of the process pulling apart colored stalks exploring indications video camera №3 and №4 by recording DVR 7. By dismantle necessary units inclined cameras spacer experimental setup can be investigated factor of leveling biomass feed each of the abovementioned giving bodies separately, and in setting them in place - in the complex. Moreover, for the various agricultural crops. The experiments were performed in triplicate on the weight of the sheaf of soybean, sunflower, rice, barley, alfalfa, pasture plants seeds and other agricultural crops. Moisture content of grain and straw, stalk length is determined by the existing method.

To determine the required power of to actuator transporter reequipped leveling device and serial inclined cameras used tensometric equipment, calibration is carried out before and after triplicate experiments. Determined the statistical error in calibration shaft inclined transporter and shaft spacers, then oscillograms is treated by variational statistics method.

Results and discussion

Application of the proposed method with the device allows more promptly and more accurately assess and determine the numerical values of the coefficient biomass of leveling working elements harvesting machines, in which was made measurements of biomass leveling coefficient.

The concept of "customization" requires interactive communications with all parties involved in the development of specifications and production, including researchers, customers, suppliers, employees, as well as communication with manufacturing equipment. Within this framework, researchers and manufacturers are striving to communication between machines and products.

In the invention, the process determining biomass leveling coefficient coming into threshing - separating device (TSD) harvester achieves a high degree of automation, handling and the assembly time is reduced to a minimum. In the future, all the components (inclined camera, distribution board, processing center) can not only carry out the programmed operation, but also self-identify and determine what actions should be performed with the new inclined camera of combine harvester.

Researcher value will only increase, he will perform less mechanical work and more active involved in the creative process, planning, management and control during complex and time-consuming experimental research. One of the important tasks for researcher will be to assess the completeness and quality of data, as well as searching more simple structural solutions. In the future, a new method of determining the biomass leveling coefficient coming into threshing and separating device harvester will carry with them knowledge of himself and said distribution board inclined camera, way it should be.

What kind of parameters should have distribution board new generation inclined camera during harvesting different types of agricultural cultures? Cereals, legumes, oilseeds, technical, fodder, pasture plants or other agricultural crops? May be a mixture of all these? However if so, in what proportion? What is the distribution board of inclined camera is optimal? Cereals, oilseeds and herb seeds? What is important? Inclined camera combine harvester with a distribution board looks simple, but the options, that can be performed on it are endless.

Conclusion

The new method of determining biomass leveling coefficient coming into TSD combine to determine distribution board inclined camera, way it should be and what parameters should own distribution board new generation inclined camera during harvesting different types of agricultural cultures. Due to the new mechanical-technological principles of recognition and determining the biomass leveling coefficient coming into TSD combine - the experimenter (the researcher) will perform less mechanical work and more active involved in the creative process, planning, management and control during complicated and time-consuming experimental research.

One important task will be to evaluate completeness the researcher and quality of data, as well as searching more simple structural solutions, which leads to the main effect - improving the accuracy coefficient measurements of leveling biomass coming into TSD combine.

Such research offers great opportunities for fast creation of perspective working parts harvesting machines of the new
generation, and the method of determining the biomass leveling coefficient research for different types of agricultural cultures will form the basis of new state standards.

**Literature**

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