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Design and Fabrication of Sunflower Header in Combine Harvester

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Abstract- The problem that farmers have while attempting to extract the seeds from the sunflower is the focus of the present research project, which aims to find a solution to the problem. Sunflower producers are forced to depend on human methods since they do not have access to the required machinery for threshing sunflowers. During the manual production of sunflowers, the threshing process is the most time-consuming and labor-intensive stage. This process entails using a power tiller treading machine, a stick, or rubbing the sunflower heads against a rough metal surface. The objective of the project is to construct a machine that is capable of removing the seeds from the sunflower. The key components that are required to make the machine are the blades, the shaft, the pulley, the disk plates, the blower, the hopper, the tray, the sieves, the motor, the V-belt, and the pillow block bearings. For the sunflower threshing unit to function properly, the movement of the material in an axial direction is the fundamental principle. When the sunflower is processed via a closed threshing machine, the seeds are separated from the flower by means of spinning blades, and the flower husk is removed by means of a blower. After the seeds have been washed, they are collected on a tray. Sunflower, Seed Extractor, Design and Fabrication, and other related terms are included.

Keywords: sunflower, machinery, Seed Extractor

INTRODUCTION

In the genus Helianthus annus, the sunflower is classified as a particular species. The name "helios" comes from the Greek word for sun, and the word "annus" represents the fact that the flower is an annual. According to popular belief, the term "sunflower" originates from the plant's link with the sun, which can be seen in both its look and its behavior. As a matter of fact, the sunflower is quite similar to the sun in form and appearance. Imagine a big circle with flaming rays of dazzling yellow emerging from it. This is how you would portray the sun in a picture when you were a youngster at the time. There is no doubt that it is reminiscent of a sunflower, you agree? The sunflower is seen to constantly watch the location of the sun in the sky, which is the second and most remarkable element of the sunflower. This phenomenon, which will be discussed in further detail below, is known as heliotropism. Sixth It is nine Due to the fact that oilseed sunflower types contain roughly 40–50% oil by weight, the sunflower has the potential to generate a substantial quantity of oil per acre when it is planted. Sunflower seed yields may be as high as three thousand pounds per acre; however, it is more common to discover that they fall somewhere in the region of one thousand two hundred pounds per acre. On the other hand, insect pressures and the initial seed selection have a greater impact on the harvest of sunflower seeds than dry periods do. [7]: The sunflower, scientifically known as Helianthus annuus L., is a very important oil crop that ranks sixth in terms of oil output (FAO, 2009). Nevertheless, it is the most sought-after item in a number of nations, with Turkey and Iran being among them. The quantity of sunflower seeds and oil that are produced is a significant factor in determining their prices. The capacity of sunflower seeds to be produced is a crucial factor that plays a big role in the growth of the processing sector. In accordance with the estimates published by the FAO in 2010, it is anticipated that the global supply of sunflower seed oil for the year 2008-2009 would amount to 11.7 million tons. This figure reflects an increase of 18% compared to the previous marketing year. [10] [10] The difficulties that farmers in the neighborhood of Erode found while trying to harvest sunflower kernels served as the impetus for the work that is being presented here. The process of removing the seeds requires a considerable amount of time as well as a great quantity of effort. The only two options available to farmers are to either remove seeds manually or to depend on companies that provide them with large equipment to do it. Farmers are forced to choose between the two options. To extract the seeds, they either manually thrash the sunflower with a metal hammer or slide it over a wire lattice. Both of these methods are quite effective. This approach is fraught with a great deal of difficulty and calls for a substantial amount of effort, which ultimately results in a loss of both time and energy. The second option required them to pay a cost to the industries and remove the seeds, which would also be a hardship and a

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loss for the producers. In addition, the seeds would be removed. As a result, the conceptualization of our project will be of great advantage to the producers, both in terms of the amount of money and the amount of work.

Materials and Method

Chopper unit

For the purpose of this experiment, a ClaasLexion 530 harvester equipped with a sunflower heading of 4.2 meters in width was used. Specifically for the sake of this investigation, the sunflower heading is created. It has been determined that the header operational width dimension consists of six lines of golden sunflower harvest. Seventy centimeters is the normal distance between rows of sunflower seeds in this region. Because of this, the operating width of the chopper unit was decided to be 2190 millimeters for the sake of simplicity in both manufacture and usage. It is possible for a chopper unit to cut three rows of sunflower stalks if it provides this operating breadth. A pair of chopper units may be found underneath the cutting bar of the header. There are three chopping blade modules that are included in each group of chopping units, and the number of groups may be varied according to the operational width of the combine harvester. The chopper unit is comprised of several components, including the main body, the main shaft, three bevel gear mechanisms, four bearings, and three blade modules.

The chopper unit is powered by the engine of the combine harvester, and motion is transmitted to the axle that is capable of carrying the chopping pieces via a chain transmission system and a transmission box. The lower engine speed is increased to the greater blade speed via the gearbox in order to limit the amount of torque that is produced. The movement of the chopper unit is transferred to the main shaft via the use of a chain drive system. The transmission box has a rotation speed of 580 revolutions per minute (rpm) at its input, while the rotation speed at its output is 2443 rpm. Within the chopper unit, there are three bevel gear mechanisms that are present. Using these bevel gear systems, the rotation speed of the main shaft is enhanced from 1396 revolutions per minute to 2443 revolutions per minute. Figure 1 depicts the location of the gearbox gear system associated with the transmission box as well as the chopper units on the sunflower header.

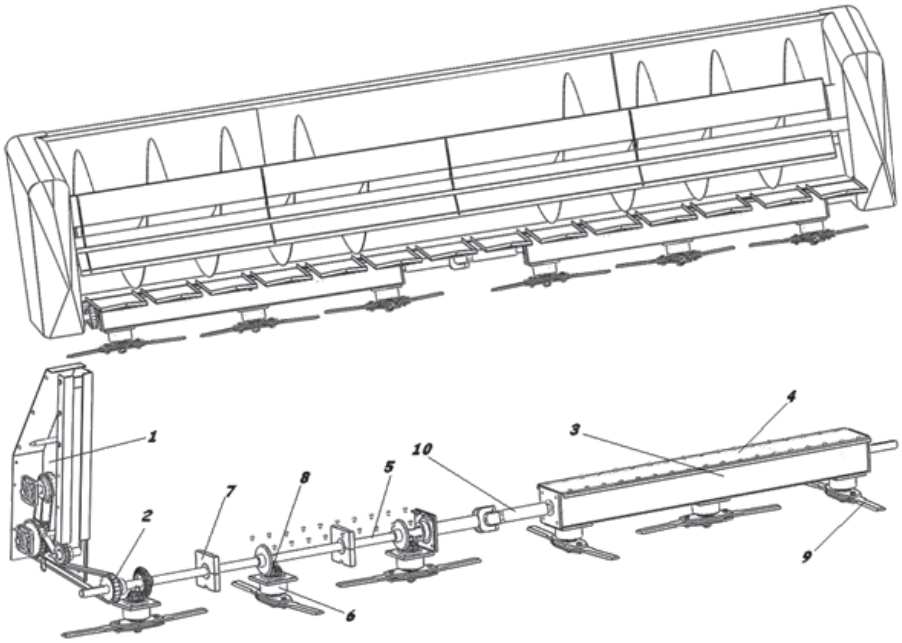

Fig. 1. The header of combine harvester and 2 chopper units:

(1) The transmission box; (2) chain gear; (3) main body; (4) main body cover; (5) main shaft; (6) blade modules; (7) bearings; (8) bevel gears mechanisms; (9) blades; (10) connection shaft

Harvesting

Harvesting sunflowers is a challenging task. "Changes in temperature, humidity, and plant moisture make setting the combine (to harvest sunflowers) a moving target from day to day and even from hour to hour," according to a farmer who cultivates sunflowers.

After being planted, sunflowers are normally ready to be harvested 120 days after the planting date. Additionally, environment and genetics also have a role in this. It is for this reason that the bulk of South Dakota's sunflower harvest occurs in the month of October; however, some fields are often harvested in the month of September,

while others are harvested as late as November.

Sunflowers are considered to be physiologically mature when they have reached the R9 stage of development, which is when the back of the head has gone yellow and the bracts have turned both yellow and brown. Wetness of the seeds is now at or below 35%.

There is a possibility that some gardeners may choose to desiccate their sunflowers in order to accelerate the harvesting process. It is important to wait until the sunflowers have reached their physiological maturity before use of a desiccant. This will avoid a loss in both yield and quality. There are a number of benefits associated with early harvesting, including reduced losses due to lodging, breakage, and damage caused by birds. Moreover, it has the potential to alleviate the demands placed on time, labor, and equipment, so allowing farmers the liberty to extend the harvesting period. An early harvest might also make it simpler to plant winter wheat, if that is something that is wanted. There is information on products that are designated for desiccation on sunflowers that may be found in the South Dakota Pest Management Guide for Alfalfa and Oilseeds. Timing is of the utmost importance when applying desiccants. K. Howatt, a professor at North Dakota State University, has uploaded a video clip on desiccants to the website https://www.sunflowernsa.com/ growers/HarvestingStorage/Desiccant-Considerations/. It is necessary to dry sunflower seeds that were collected with a higher moisture content before they are put away for storage. When it comes to seed storage, a moisture level of 9.5% is considered to be safe.

Combining sunflowers with corn, small grain platform headers with pans, or row headers are all possible planting combinations. Over the course of history, row crop headers have been used extensively. In spite of this, a number of companies have developed sunflower heading options over the last several years. Combination headers that are designed specifically for sunflowers are also often encountered in today's market. Additionally, growers have the option of using certain conversion kits or harvest accessories that are designed to be added to their corn head. For every header, it is essential to collect as many heads as possible while minimizing the quantity of stalk that is brought into the combine, as well as the amount of cracking and seed loss that occurs during the process. When the concaves are left open, the speed of the cylinder is restricted to threshing the seeds, and the moisture content of the seeds is in the low teens, threshing sunflower heads helps to minimize the amount of seeds produced. At the point that they leave the combine, whole sunflower heads should ideally only include seeds that are empty.

Material and methods

In order to do this, a four-row header for the Delta plot combine was designed and manufactured for the purpose of harvesting breeding plots. Figures 1 and 2 illustrate the architecture of this equipment as well as its fundamental function. The header design is protected by the patent number 179951, which was issued by the Russian Federation.

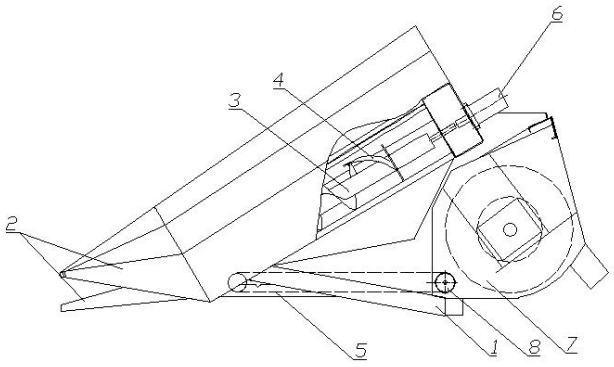

Fig 2

Viewed from the side frame, stem dividers, and screws, in that sequence, this is a diagram of a four-row header for a Delta combine that is used to harvest sunflowers; pair with four cuts; The conveyor belt, six hydraulic motors, and seven header transverse screws are the components. (8) Drive shaft for the conveyor

Results and discussion

According to the requirements of the Russian National Standard 28301-2015 (GOST 28301-2015), an experimental investigation was carried out.

An examination of the data reveals that the tall confectionery variety Dzhinn plants and dwarf hybrid plants have

stems that are cut with heads that are almost the same size. The height of the stems is 15.0 cm for the tall variety and 25.8 cm for the dwarf hybrid. Due to the fact that the heads only enter the thresher of the combine with such a little amount of stem material, the performance of the combine is significantly improved. Due to the fact that the seed coat of the Candy Dzhinn variety is less resistant to the effects of applied force, this particular variety was chosen for the purpose of analyzing the acquired mass.

Through the use of the Russian method, the seed bulk characteristics of the Dzhinn sunflower variety were identified.

Fig. 3. General view of sunflower harvesting devices: model

Bevel gears are designed to operate conveyors for stems and seeds, in addition to cutting devices. The drive gearboxes are positioned on opposite sides of the device's cardan shafts. Lifters on both sides comprise a separator and a frame that supports the powered roller of the seed conveyor belt. The divider may assume two positions: lower (operational) and upper (transportation). Each cutting machine comprises a disc affixed with specialized blades and an anti-cutting plate secured to the glass of the conical reducer. The configuration of lifters on the sunflower cleaning devices NASH-873-04 and NASH-873-06 (Figure 3) facilitates the elevation or descent of the drooping sunflower stalks. These devices may vary the degree of inclination and the width of the channel via which the vibrating conveyor delivers both low-growing and high-stem sunflower kinds to the cutting machine. This characteristic enables the use of devices across all sunflower production locations and various types.

Fig. 4. General view of devices for harvesting sunflower models

Apparatus for the purification of sunflower seeds OptiSun 870-PSM (Figure 4.b) comprises a framework, screw conveyors, seed grinders, stem dividers, and cutter assemblies.

The device's frame is a welded structure resembling a gutter, composed of steel profiles and steel sheets. The screw is a welded pipe onto which the right and left winding screw tapes are affixed. The stem shredder has four pieces, each containing two rotors. The shredders operate using a hydraulic system. The hydraulic system comprises a tank equipped with a thermometer, cranes, a filter, a motion limiter valve, connecting pipes, and hydraulic motors. Chopper pumps consist of two components located on the left and right sides of the device. Every shredder comprises one pump and one hydraulic motor. Every hydraulic circuit is equipped with a pressure gauge that enables the combine to regulate the oil pressure. Stem shredders may alter their position independently of the equipment. Shredders are elevated and lowered via hydraulic mechanisms. Cutting units are designed for the provision of sunflower stems and the severance of baskets. The cutting units have two primary components: the first is a spoon chain equipped with a tensioning mechanism and a stem feeding apparatus, while the second component is the cutting machine. Dividers are intended to partition sunflower stems and guide them towards the cutting nodes. Wedge-shaped execution of sheet steel for the fixation of frame dividers made of shaped steel. The bottom section of the tops of the welded plate dividers is shaped like a shoe, facilitating surface replication of the field and enabling the elevation of fallen stems. A stubble height meter is included within the device, indicating the relative positioning of the grinder and the gadget. Corn The Sunflower-mounted ZHNS-9.1 comprises a platform and a transition frame hinge. Maize is affixed to an inclined chamber combine of any kind and slope by a stiff connection using a transition frame [3]. The platform harvester comprises a welded frame construction

equipped with a cutting equipment, lateral sides, lifting mechanisms, a blister, a reel, an auger, driving systems, and safety precautions. The right and left sidewalls are designed to segregate the sunflower stems from the array and channel them towards the header. Lifters include a sock and a gutter, designed for the separation, guidance, and delivery of sunflower stems to the cutting machine, in addition to the collecting and passive conveyance of the cut material to the header platform, discharged from the seed baskets. The Reaper is propelled by a gimbal from the inclined chamber of the combine via a chain drive connecting the counter-drive shaft to the screw drive shaft, together with a belt drive to the planetary knife drive reducer. A safety clutch is affixed to the screw axle, which engages upon the intrusion of extraneous objects into the header's operational components, therefore preventing damage. The chain drive from the screw axle is located on the right side driving axle of the reel.

CONCLUSION

The apparatus that was used to extract sunflower seeds was successfully built in line with the specifications that were specified in the design. It is easy to use and maintain simultaneously. For the purpose of this project, the objective is to complete the required tasks in the least period of time possible. This concept is practicable from a financial standpoint, and we feel that it has the potential to be reduced even more if it is made on a large scale. The threshing efficiency of the project is 99.76%, and it is designed to be of great assistance to farmers. There is a loss of 0.238% of seeds, and there is essentially little harm to the seeds.

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