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Improvement of the Design of the Device for Peel Grinding

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Abstract: The article proposes an improved design of a device for peeling grain used in the food industry. The principle of the device is described, which allows to reduce grain breakage, increase the speed and quality of processing. The performance of the device is increased by increasing the speed of removal of husk from the grains.

Keywords: Grains, nutritional value, germ, grain starch.

Introduction

Grain mass of wheat, purified from impurities, is not yet prepared for grinding, since on the surface of individual grains there is a significant amount of mineral dust and microorganisms. When processing such grain, the quality of the flour deteriorates, and in some cases the flour may be unusable. The increased content of microorganisms in the flour during long-term storage causes mold and even self-heating. The presence in the flour of particles of shells, a birth and a beard also negatively affects its quality.

Shells degrade the color of flour and lower the nutritional value, since they are not absorbed by human organisms. The embryo is the main cause of rancidity of flour during storage and in adverse conditions, since its fats easily decompose under the influence of heat and moisture. The grain beard must be removed because dust and microorganisms accumulate in it.

Materials and methods

The aim of improving the device for peeling grain is to increase the productivity of the peeling process and increase the quality parameters of peeling [1, 2].

The fruit shells of wheat grains make up 4–6% of the grain mass, the seed shells make up 2–2.5%, while the aleurone layer is 7%, and the sub-aleurone layer is 8–11%. The endosperm contains all the starch of grain, the amount of which is 78 - 82% by weight of the endosperm; 2% sucrose; 0.1 - 0.3% reducing sugars; 13-15% of proteins, mainly glia-din and gluten, form gluten. A small amount is contained in the endosperm of ash - 0.3-0.5%, fat - 0.5 - 0.8%; pentosans 1 - 1.5; fiber - 0.07 - 0.12% [3, 4].

In the proposed device for peeling grain, containing a frame with sidewalls on which a large perforated cylindrical body is fixed, with a large working drum with a set of saws, disks with grooves and metal mesh disks on a hollow shaft with grooves (slots) placed inside . A hollow shaft with external splines is mounted over a small perforated casing, onto which sets of saw blades of disks with grooves and metal mesh disks are installed, and they are respectively made in the form of disks with round holes in the center, which respectively have straight-sided protrusions under the slots of the hollow shaft.

A large perforated housing is mounted on bearings, on the sidewalls with the possibility of rotation towards rotation of the working drum bar, with the possibility of engagement with gears mounted on axles with bearings located in the sidewalls, and the rotation of the working drum is carried out by the same two gear sprockets as (large) perforated housing only contact is made at the bottom of the sprocket. A small perforated housing is mounted on the upper rotation shaft and rotates with it in one direction. The drive provides rotation of the perforated cylindrical bodies one side and towards the working drum.

Previously, a small perforated cylindrical body is installed and fixed on the upper rotation shaft, on the outer surface of which helical teeth are fixed along its axis, which can be with variable pitch. The snare drum consists of a set of saws, disks with grooves and metal mesh disks and is mounted on an internal rotation shaft. A small perforated cylindrical body is located above the small working drum with a set of saws, grooved blades and metal brush disks.

The device for peeling contains a loading funnel and the upper and inner shafts of rotation, and a screw blade is installed in the inner shaft at the beginning from the grain supply side, and at the end two screws are fixed on the outlet of the sheaf on the inner surface along its axis, an electric motor it transmits rotation by a belt drive and a gear pair, on the inner surface of the (large) perforated cylindrical body there are helical teeth along its axis, and gear wheels with internal gears are fixed on its end parts .

The drive provides both perforated cylindrical bodies to meet the rotation of the working drum, which allows to accelerate the rotational movement and mixing of grains in the area of the inner surface of the perforated body, and the teeth additionally provide peeling, and accelerate the speed of mutual interaction when the grains move among themselves. Due to the rotation of the perforated body, a centrifugal force additionally acts on the shell-hu, which accelerates the process of its removal through the holes.

Perforated cases carry the grains into a rotational movement, while pushing the grains away from the walls of the body by impacting the grains with their teeth, thereby providing free access of the husks to the perforation holes. Thus, in the annular layer, the grains move relative to each other and are simultaneously compressed by centrifugal forces. As a result of friction of the grain against the grain, their intensive desquamation occurs without damage to the endosperm.

A significant difference is that the saws, disks with grooves and metal mesh disks have round holes in the center, on which the contours of the saws, disks with grooves, and brush disks have straight-side protrusions mounted on a hollow shaft with longitudinal grooves and provides installation under it of a small perforated casing with a casing inside, which can be installed a snare drum with a set of alternating saw blades with disks from grooves and brush disks on the inner shaft of rotation. The rotation of a small perforated cylindrical body with teeth along a helical line on the inner surface, which can be with a variable pitch to meet the working drum, allows intensive mixing of grains and interaction between them along a helical line and eliminates the formation of a stagnant zone in the outer perforated housing surfaces and improved machining quality.

Due to the presence of teeth along the helix, which can be with a variable pitch, on the inner surface of the (large) perforated cylindrical body and rotation towards the working bar-ban also allows intensive mixing of the grains. And the interaction between the grains along the helix eliminates the formation of a stagnant zone on the inner surface of the perforated cylindrical body and increases the quality of peeling.

The installation of a screw blade on the inner surface of the shaft from the side
of the grain supply allows the supply of a sufficient amount of grain to the peeling zone, and two screws installed at the husk exit ensure timely removal of it.

Device for peeling grain

The figure shows a General view of the device in longitudinal section. The proposed device consists of a frame 1, sidewall 2, an internal rotation shaft 3, an electric motor 4, pulleys 5,6,13,21,38 of a belt 7 and perforated cylindrical housings 8 and 12. The housing 8 is located in the casing 9 on bearings 10 on sidewalls 2. Sidewalls 2 are mounted on the upper rotation shaft 28 with bearings 34, 37. On the inner surface of the perforated housing 8, gears 11 with internal teeth are fixed on both sides (ends). Inside the housing 8 on the shaft 28 there is a large working drum 57, made in the form of a hollow cylinder with longitudinal grooves, which is mounted on the flanges from the ends and secured by threads with disks 39. On the drum 57, a set of alternating saws 14 and disks 15 with grooves, and then from a set of brush disks 16, is installed. The working drum 57 is attached to the flanges 29, 30 at the ends by a thread. The sidewalls 2 are mounted on bearings 34, 37 on the shaft 28. On the sidewalls 2 are mounted on bearings 27, 35 and axles 23, 50, gears 20, 26, respectively. The axles 23.50 are mounted on the sidewalls on bearings 27, 35. Two flanges 29, 30 are mounted on the shaft 28, on which teeth are cut near the sidewall 2, which are in contact with the gears 19, 26. Saws 14, disks 15 and brush are fixed on the shaft 3 disks 16 with ends threaded by disks 31. On the flanges 29, 30 from the ends, the teeth are in contact with the gears 19 and 26, respectively. A screw blade 56 is installed on the outer surface of the housing 8. Between the casing 9 and the perforated housing 8, in the exit zone rings 55, 58 are installed in the working area to prevent ingress Nia husk, various-shells is in the clean grain. The grain 45 is loaded through a funnel 44, mounted on the frame 1 with a screed 54, and enters the inner cavity of the shaft 3, wherefrom the screw blades 60 feeds the grain 45 through two cross-shaped holes into the inner cavity of the perforated body 8, into the area of the large and small working drums. The upper shaft 28 consists of two parts and in the middle there is a perforated housing 12 and flanges 29, 30.

Result and discussion

When the shafts 3 and 28 are rotated due to centrifugal forces, the grains 45 move to the inner surface of the perforated body 8 and 12 as well as to the saw teeth 14, 36, the disk with grooves 15, 42 and the metal mesh disks 16, 46 from where they come to peeling the space between the perforated casing 8 and 12 and the large and small working drums. The rotation of the perforated housing 8 is carried out from the electric motor 4 through the pulleys 6, 21 and the shaft 28 and the internal gearing of the wheels 22 with the wheels 20, 19, 26 and the internal gearing of the wheels 11. And the rotation of the perforated housing 12 is carried out by the belt 7 with pulleys 6 and 21 and a shaft 28 on which it is fixed.

On the inner surface of the cylindrical perforated cylindrical body 8, helical teeth 18 are installed. And on the outer surface of the perforated cylindrical body 12, helical teeth 18 are installed and fastened. On the casing 9 there are holes 51 and 52 for removing husks and peeled grain. On the perforated cylindrical body 8 there are holes for removing the husks 61. There are also holes on the perforated cylindrical body 12 for removing the husks. Holes are present on the shaft 3 in the area of the working drum also for removing husks through its internal cavity.

In the area of attachment of the perforated cylindrical body 12 on the shafts 3 and 28 there are cross-shaped holes for removing husks from the peeling zone of the snare drum. The casing 9 is mounted on the frame 1. In the space between the casing 9 and the perforated cylindrical body 8, gaskets 55 and 58 are installed so that the husks 61 do not get where the grains 45 are. To protect the drive on the sidewall 2, the casing is installed on the side of the electric motor 4 59.

A device for peeling grain works as follows.

When the motor 4 is turned on, the rotation is transmitted through the pulley 6, the belt 7 to the pulley 21 mounted on the shaft 28. From the shaft 28 is transmitted through gears 17, 38, pulleys 13 and 37, wheels 19, 26, 11 to the perforated cylindrical body 8 Also, rotation is transmitted from the shaft 28 through the gears 22, 20, 19, 26, to the teeth of the flanges 29, 30 and to the large working drum. The perforated housing 12 with the casing 32 sidewalls 25, 33 at the ends fixed to the shaft 28.

The rotation of the perforated bodies 8, 12 is carried out to meet the rotation of the large and small working drums. From the funnel 44, through the cavity of the shaft 3, the grain 45 enters the inner perforated body 8 through two cross-shaped holes,

where due to the rotation of the perforated bodies 8, 12 and grain support under the action of centrifugal forces, they are distributed over the inner surface and fall under li 14, 36, the disk 15, 42, then under the brush disks 16, 46 and then poured into the discharge zone. To remove the husked grain, the hole in the perforated casing 52 has a hole. The husk 61, separated from the grain, is removed through the holes 51. The grain 45 passes through the cavity of the shaft 3 into the internal cavity of the perforated casing 8 and the small perforated casing 12, where due to the rotation of the large and small the drum and the perforated body 12 under the action of centrifugal forces are distributed under the internal saw blades of the disks 14, 36 of the grooves of the disks of 15.42 then the bristles of the disks 16, 46 are then poured into the discharge zone, where to remove the peeled grain in the flange 30 holes, then there is a hole 52 on the casing 9. The husk 61 through the holes enters the inner cavity of the perforated body 12 from there with screw blades 43, when rotating, the husk is pulled into the removal zone. Further, when the shaft 3 is rotated with screws 53, the husk 61 enters through the cross-shaped holes in its internal cavity and is removed outside. Also, the husk 61 from the cavity between the casing 9 and the perforated housing 8 helps to remove the helical blade 56 during rotation of the housing 8. When rotating the large and small working drum and perforated bodies 8, 12 towards each other, the grains are carried away by the active surface of the working drums and helical teeth 18 and ensures uniform mixing of the grains.

Due to the presence of helical teeth 18 and a device mounted at an angle to the horizontal, the grains 45 acquire a rotational and longitudinal velocity due to helical teeth relative to their axes from the perforated layers towards the annular layer of grains. Due to the rotation of the perforated bodies 8, 12 towards the big and small working drums, the speeds of the grains inside the annular zone are significantly increased relative to each other, which allows for the intensive movement of grains, thereby increasing the intensity of peeling of the grain inside the annular zones and at the same time, the wear and heating of the walls of the body is reduced. As a result of the collisions of the grains against the teeth of 18 perforated bodies 8, 12, respectively, leading to the movement of the grains in the direction of the mixing zone, due to friction between them, the shell of grains 45 is separated. Separated husk 61 from grain 45 in contact with large and small working drums due to centrifugal forces moves to the inner surface of the perforated body 8 from where it is removed through the holes 51. The husk 61 is pulled out by screws 53 when the shaft 3 is rotated through the cavities of the perforated body 12, the shaft 3 and is removed outside at.

Due to the performance of two working drums from saw blades, grooved disks and brush disks and, accordingly, two perforation bodies, the peeling performance increases sharply. The proposed design provides the same annular layer of grains and the peeling mode is improved, the quality is improved. By rotating the perforated bodies 8, 12 with screw blades and teeth on the inner and outer surfaces, respectively, the possibility of adjusting the angle of inclination of the device reduces grain breakage, increases the speed of the peeling process, removes the husks and increases productivity, i.e., the yield of processed products and quality.

Conclusion

Technical and economic efficiency from the use of the considered device consists in increasing the productivity and quality of grain peeling, in reducing the number of device for peeling grain, in the possibility of peeling various types of grain, in expanding the functionality of the device for peeling grain.

References

1. A device for peeling grain. Patent for the invention of UZ IAP 04179. Authors: A.N. Normatov, P.M. Tursunhodzhaev, A.M. Mutalov, D.A. Gafurova. Publ. 2010. Bull. Number 6.
2. A device for peeling grain. Utility Model Patent. UZ FAP 00724. Authors: U.N.Baltabaev, P.M. Tursunhodzhaev, I.N. Khusanov, G.N. Tsoi. Publ. 2012. Bull. Number 5.
3. V.N. Nevzorov, I.V. Matskevich, E.N. Oleinikova [et al.]. Deep processing of wheat grain // Problems of modern agrarian science: international materials. extramural scientific conf. - Krasnoyarsk, 2017 .-- S. 40-43.
4. Brasalin S.N. Evaluation of the technological effectiveness of peeling grain in cereal production // Bread products. - 2014. - No. 9. - S. 60-62.